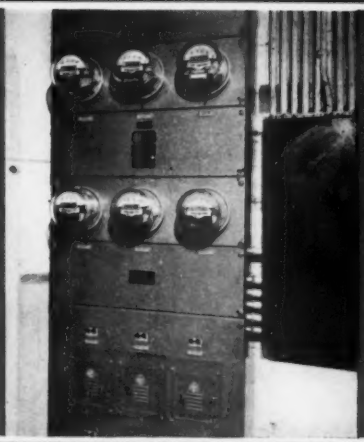
AUGUST 1951
PRICE 35 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

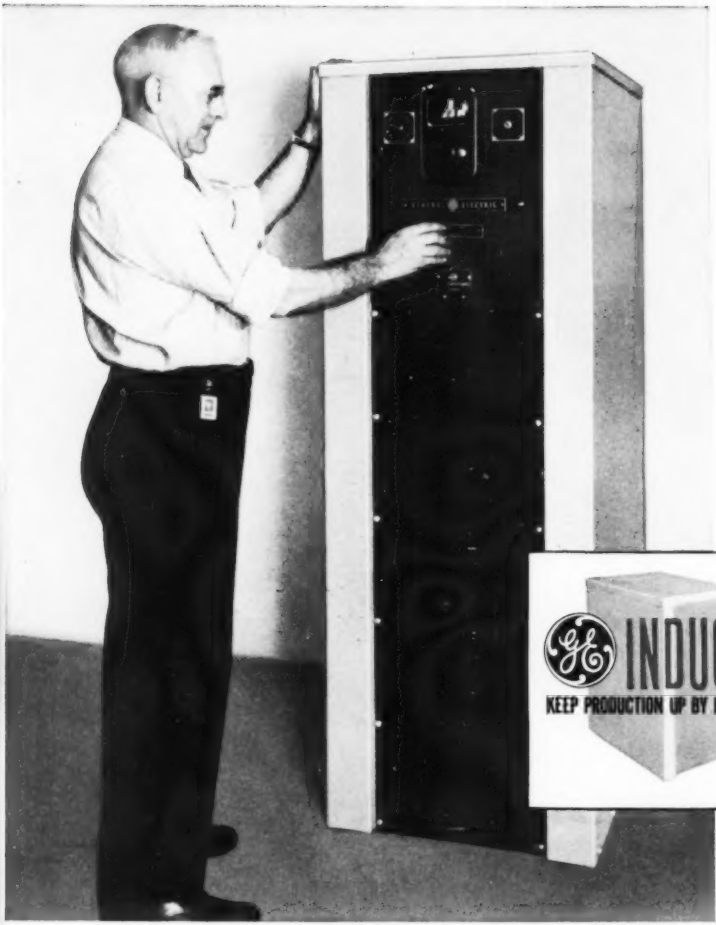
HIGH-LEVEL *illumination insures accuracy and eliminates eye fatigue in industrial die-forming.*



STANDARD PANELS *in common enclosure provide economical multiple service installation.*

PRODUCTION X-RAY *gaging of steel tubes accurate electronic power stabilization.*

A McGRAW-HILL PUBLICATION 50TH YEAR



This new three-phase Inductrol gives you more kva of regulation in a smaller floor space than ever before.

General Electric's NEW INDUCTROLS

(dry-type induction voltage regulators)

will help you get out more production

Poor voltage can mean sluggish performance of electrical equipment—and reduced output. To be sure you are getting the motor performance and lamp brilliance you pay for, keep voltage up with General Electric's Inductrols.

New, improved Inductrols have been introduced this year for both single-phase and three-phase circuits, 600 volts and below. These new dry-type regulators automatically maintain correct voltage on your equipment. They do not require expensive fireproof vaults. The attractively styled all-steel cabinets completely enclose all live parts for greater safety. Standard automatic regulators are available for circuits ranging from 3 kva, 120 volts up to 500 kva, 600 volts.

For advice on how, when, and where to apply Inductrols, get in touch with your G-E sales representative or authorized agent.

Write for Bulletins GEC-712 and GEC-795. *General Electric Company, Schenectady 5, New York.*

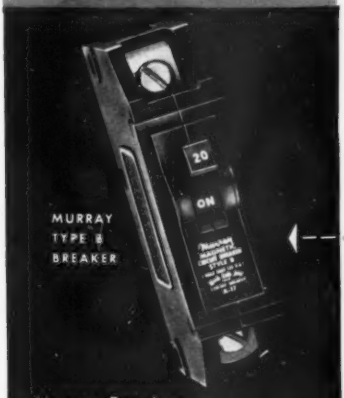
404-81

GENERAL ELECTRIC

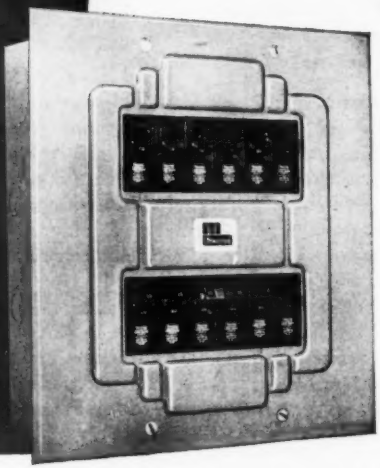
NEW!

the Murray "12" Circuit Protector

with *Fully Magnetic* breakers



Murray Breakers always carry full load regardless of temperature. Heat will not affect them—they never need "derating." Breakers are interchangeable with other new single pole individually housed breakers. This means utmost flexibility for you with a minimum stock.



Standard package—LG006G—Surface or Flush. Four 15 Amp. plus two 20 Amp. breakers with provision for six additional breakers. Six pairs of handle extensions supplied.

All Circuit Protectors are single phase, 3 wire, 125-250 Volts AC, insulated groundable neutral.

NOW! A trim, compact 12 Circuit Load Center has been added to the Murray Line. All Murray Circuit Protectors are suitable for use as service equipment.

No main switch is required ahead of the "12" and "8" Circuit Protectors, providing the number of operating handles is limited to six by the use of handle extensions. (National Electrical Code, Par. 2371-a3). Adjacent breakers in positions of opposite polarity, when equipped with handle extensions, give two pole (independent trip) operation.

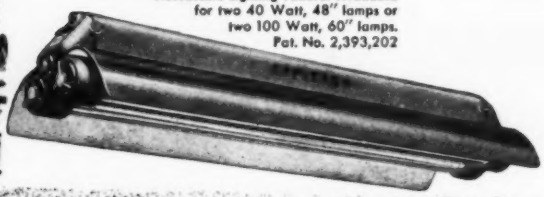
Write to-day for further information on these and other dependable Murray products.

Murray®

MURRAY MANUFACTURING CORPORATION
1250 Atlantic Avenue • Brooklyn 16, New York

Service Entrance & Meter Equipment · Magnetic Circuit Breakers · Switches
Current Limiting Reactors · Crows'nest Aerial Ladders

Type EFU—First and still finest Explosion-Proof Fluorescent Lighting Fixture. Available for two 40 Watt, 48" lamps or two 100 Watt, 60" lamps. Pat. No. 2,393,202



Industrialite High Mounting Fixture—For railroad yards, steel mills, round houses—any industrial plant calling for a ruggedly built, high-mounted lighting fixture.

BETTER LIGHT *for* BIGGER PRODUCTION

RLM Standard Dome Fixture—Reflector made of rust-resisting iron and finished with three coats of baked porcelain enamel. Sectionalized construction permits easy installation, convenient servicing.

Stocklite—Provides perfect illumination for shelves and bins in stock rooms.

Fewer rejections . . . greater safety . . . better employee relations . . . increased efficiency to meet defense demands—these are the immediate returns on an investment in good industrial lighting.

Appleton Industrial Lighting Equipment is precision-designed to provide *good light*—the right light, without uncomfortable glare, troublesome contrast or shadow. Expert engineering, unequalled manufacturing facilities and nearly a half century of experience are combined in each Appleton fixture to provide maximum efficiency at minimum installation, service and operating expense.

Appleton Lighting Fixtures are made to suit every industrial requirement—including hazardous locations—whether indoors or out. For the finest illuminating equipment or expert assistance on any lighting problem, contact Appleton—Standard for Better Lighting.

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PRODUCTS

EXPLOSION-PROOF FITTINGS · FLEXLITES

ELECTRICAL CONSTRUCTION AND MAINTENANCE

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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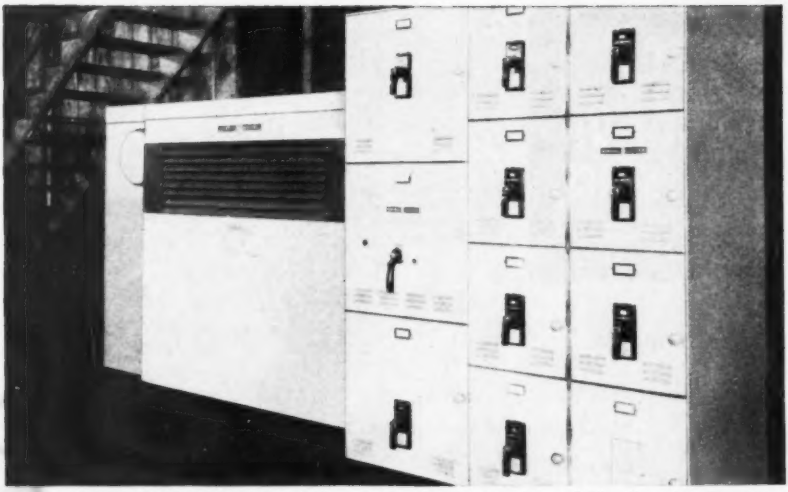
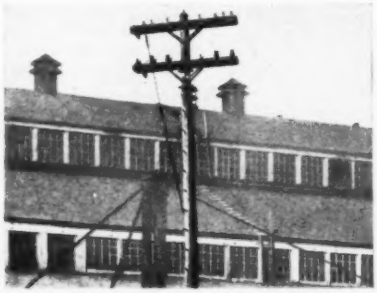


MODERN G-E LOAD CENTER UNIT installed at the Traylor Engineering and Manufacturing Co., Allentown, Pa. This unit consists of a dry type transformer and switchgear, completely enclosed in steel. Power is received at 2400 volts and stepped down to utilization values. Note placing of unit in waste space under stairway.



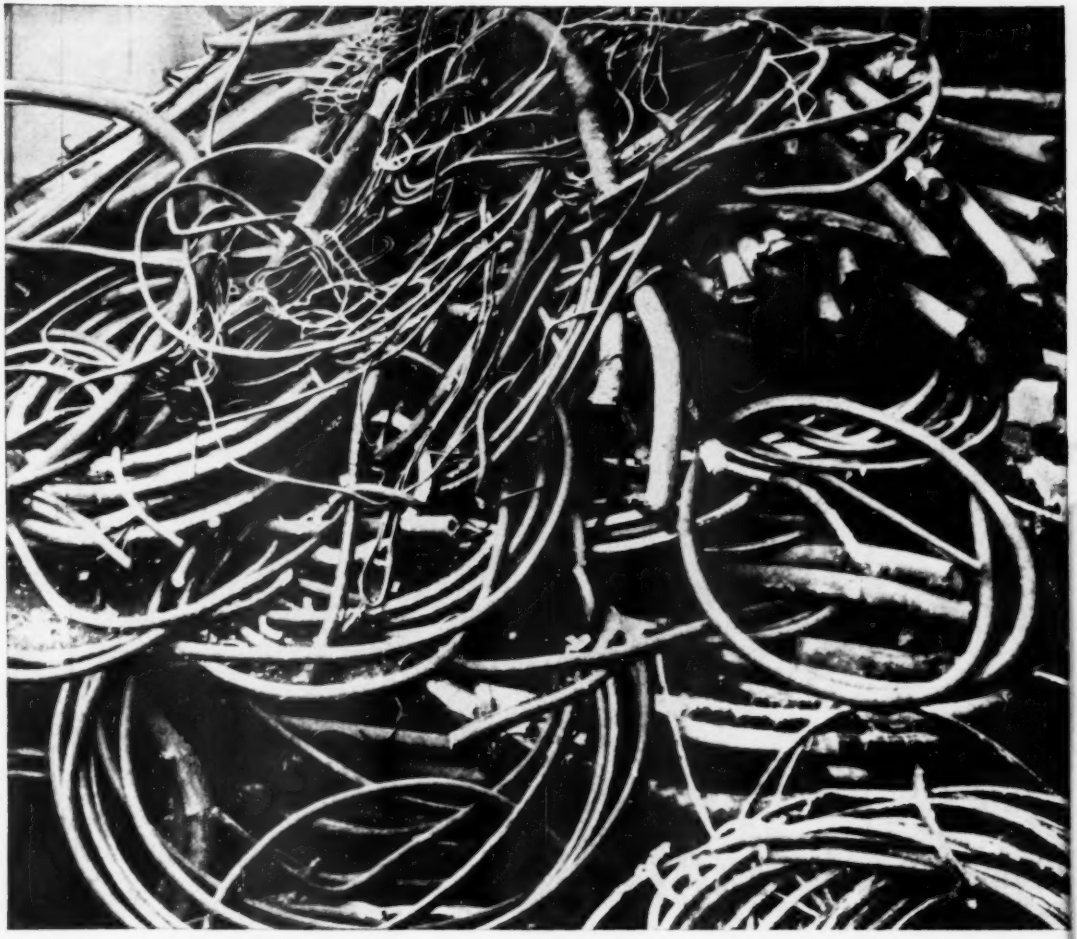
BEFORE—AND AFTER! Here are photos of poles that carried the old 240-volt distribution lines, before and after the cables had been removed. The many low voltage cables have now been replaced by a 3-phase cable installed underground.

LOAD CENTER SYSTEM

Replacing an octopus of long, heavy 240-volt distribution lines, three small high voltage cables now carry all the power required for expanded, more efficient production at the Traylor Engineering and Manufacturing Co., Allentown, Pa.

If the old system had been continued, more than 10% additional copper would have been required to provide for expansion. This is more than the amount necessary for the new high-voltage cable, which will carry all the power required for years to come.

Today, power is distributed at 2400 volts to various G.E. Load-center unit substations like the one above, where it is stepped down to utilization values. Because load-center units are located close to the machines they serve, secondary feeders are kept short, saving expensive



SAVES TONS OF COPPER

low-voltage copper. Although the new high-voltage lines are more than 90% smaller in size than the old low-voltage distribution cables, they carry considerably more power.

After the new load-center system had been installed, the pile of copper cable shown above was all that remained of the old outdoor, pole-mounted, 240-volt distribution system at the Traylor Engineering & Manufacturing Co. Over and above the salvage of vital copper in this cable, the Traylor Company actually saved copper in putting in its new high-voltage distribution system.

For complete information on this modern power supply system for your plant, write for Bulletins GEA-3592 Load Center Unit Substations and GEA-3758 Load Center Power Distribution. *General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

321-75

40% Saved on new wiring

At Stewart-Warner Electric's radio and television plant in Chicago, 4/0 Aluminum RH insulated conductor supplies 440-volt AC power for a new assembly line. Savings due to using Aluminum amounted to over 40% because of the cable's low initial cost and the easier, faster installation of the lighter-in-weight metal.

Electricians Howard Norton (left) and Al Iverson soldering aluminum connections at distribution panel. *Below:* Howard Norton, looking over completed job at panel said, "Aluminum is very satisfactory to install because of its lightness and workability . . ."

figure your new wiring job in Aluminum and figure low

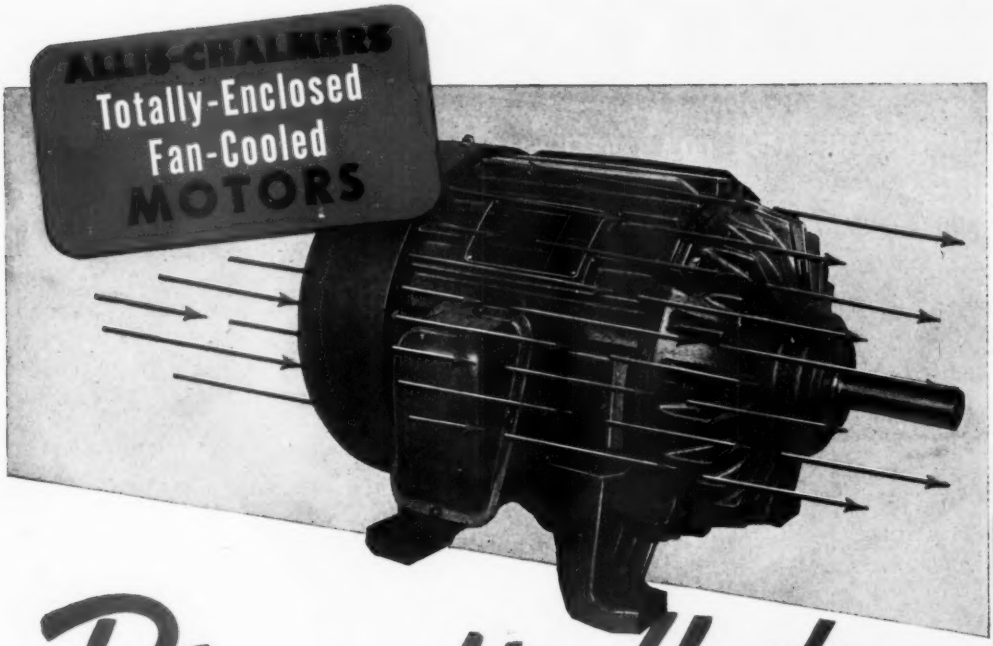
Get prices both ways—in Alcoa Aluminum and in copper. See for yourself the worth-while savings possible when you plan wiring for production lines, new power feeders or improved wiring for higher capacities.

Although the rearmament program restricts the use of Aluminum we are ready to help you with the planning for trouble-free, low-cost wiring. For information write ALUMINUM COMPANY OF AMERICA, 1775H Gulf Bldg., Pittsburgh 19, Penna.

Aluminum Conductors

ALCOA ALUMINUM

of ALCOA EC ALUMINUM are made by leading manufacturers



Blows itself clean as a Whistle!

DIRT IS CARRIED AWAY by cooling air blown over the ribbed cast iron frame and bearing housings of this new Allis-Chalmers tefc motor. That means less motor cleaning . . . inspection . . . overhaul!

Concealed air passages and pockets have been eliminated. Dirt can't build up to cause overheating. And as for oily dirt that sticks — just wipe or blow it off.

Studies show that on most applications, totally-enclosed fan-cooled motors more than pay back their extra cost in reduced maintenance. And this new Allis-Chalmers Type APZ tefc motor makes maintenance costs lower than ever before.

Rigid Construction

The frame is cast iron which has high resistance against corrosion and distortion. Bearings are pre-lubricated at the factory and should need no attention for years. Tapped holes with pipe plugs to permit regreasing and to provide grease relief are standard equipment.

Get All The Facts

The new Allis-Chalmers Type APZ totally-enclosed fan-cooled motor is built in all NEMA standard frame sizes from 224* to 505. Also in explosion-proof type. Your A-C Authorized Distributor or District Office has complete information. Call today, or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B7225.

A-3427

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Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

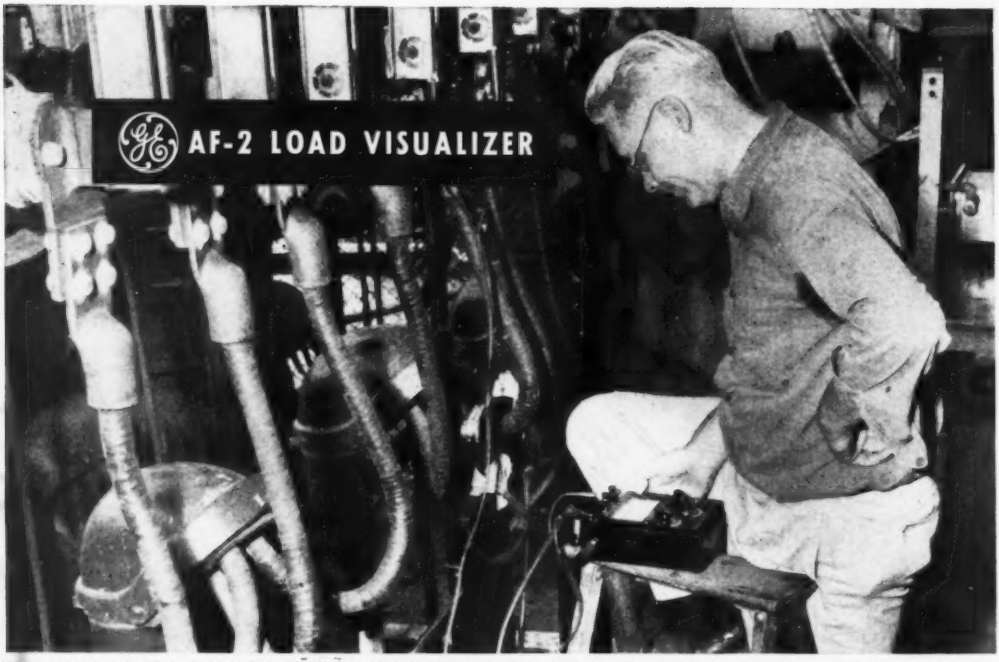
TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

*Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS

*Similar design non-ventilated motors Type APK, also available in frames 203 to 224 inclusive.



IDEAL FOR BALANCING POLYPHASE CIRCUITS—AF-2 IS USED TO DETERMINE POWER FACTOR OF TRANSFORMER-BANK SECONDARY.

REACTIVE CURRENT COMPONENT—measuring reactive component of current in an industrial-magnetizer circuit—to make sure the equipment is in good working order.

HIGH ACCURACY—volts and amperes, 2%—Component amperes, 5%—Amperes with G-4 transformer, 5%. Load visualizer has frequency range 50/60 cycles.

Five Instruments in One

Quickly and Easily measures . . . .

VOLTS • AMPERES • WATTS • VARS • POWER FACTOR

The G-E load visualizer is a short cut to economical and efficient plant maintenance. No longer must you purchase separate instruments for voltage checks, load-current measurements, power surveys, power-factor checks, and reactive-power studies of a-c circuits. This one compact, lightweight analyzer will do all five jobs—easily, accurately, and dependably.

IDEAL FOR ANALYZING INDUSTRIAL LOADS, the AF-2 load visualizer measures a-c amps, volts, watts, vars, and power factor. All readings are on one easy-to-read scale, and connection changes are simple.

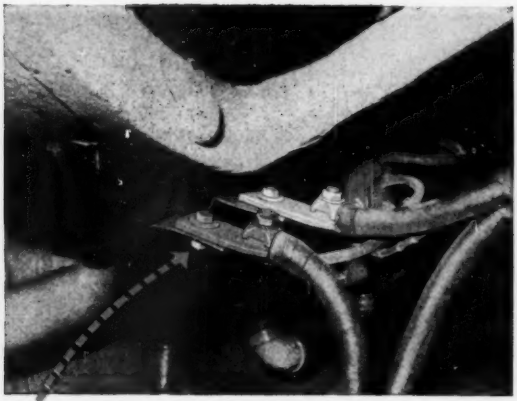
CURRENTS AS HIGH AS 1000 AMPERES can be measured when used with a conventional split-core transformer. Self-contained current ranges are 0-2.5/5/25/50 amperes. Voltage ranges are 0-150/300/600 volts. And the split-core transformer feature means no lines to cut—no interrupted service.

AVAILABLE NOW—in these days of conversion and speeded-up plant activity—the AF-2 is on the shelf—ready to be shipped on receipt of your order.

For further information see your nearest G-E distributor, or write for Bulletin GEC-372. *General Electric, Schenectady 5, N.Y.*

GENERAL ELECTRIC

602-217



to get

re-use... use QIKLUG

To cut costs, conserve materials, and make your supplies go further, it's wise today to use Burndy Qiklug connectors. Built for durability, Burndy Qiklugs are constructed of high-conductivity, corrosion-resistant alloys, with clean, husky threads... so they can be used over and over again! Added to Qiklug's ease of installation (with an ordinary wrench) and compact design, this timely, extra-life advantage makes it more important than ever to use... and *re-use*... Qiklug!

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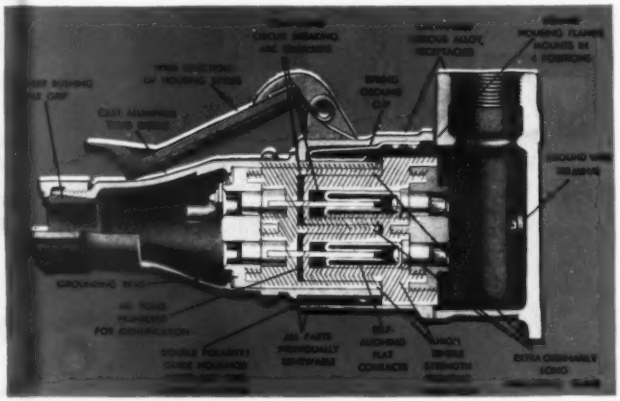
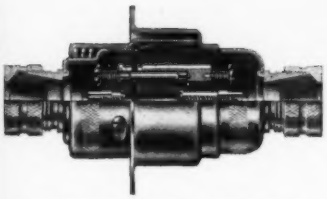
Heavy Duty Plugs and Receptacles

FOR PORTABLE ELECTRICAL EQUIPMENT

Pyle-National plugs and receptacles are built to withstand the most severe operating conditions, as proven by years of remarkably dependable service in a wide variety of industrial applications. The many substantial construction features of this extensive line of plugs and receptacles and the high quality of materials and workmanship insure safe operation, uninterrupted service and long life.



QuelArc* • *Circuit Breaking Series* **Unique partitioned insulation provides long insulated paths through air and across surfaces for exceptional protection in these current rupturing devices. Cast metal housings, high grade insulation and individually renewable contacts insure long service life. Ratings 20, 30, 60, 100 and 200 amperes, 250 volts DC, 600 volts AC—2, 3, and 4 pole—grounded through shell or extra pole. Threaded cap, plain and hinged spring door housing styles are available.**



Interchangeable reversible contact units. 1, 2, 3, 4, 6, 8 pole

Triploc* *and Multiple-Circuit Series*

A line of exceptional versatility, unequalled in the heavy duty field, with a virtually unlimited number of assembly combinations for varied applications. Offers a selection of 1, 2, 3, 4, 6 and 8 pole contact units which are interchangeable and reversible in any single set of housings. Many types of housings available of pressed steel with automatic lock and of cast metal threaded for watertight gasket seal. Multi-Circuit housings with 2, 3 and 4 contact units available for combinations up to 32 poles. Ratings 15 and 20 amperes, 250 volts DC, 460 volts AC—circuit breaking. Pressed steel fusible and fuseless plugs measure only 1 13/16" outside diameter.

Midget Triploc* *Series* **Same construction features as Triploc except for much smaller outside diameter of plug shell—only 1¼". Interchangeable and reversible contact units—2, 3 and 4 pole—are of the flat blade type. Rated 10 amperes, 250 volts; 15 amperes, 125 volts.**

General Purpose *Series* **Available with cast metal housings in many types for circuit breaking and disconnect service. 30 amperes, 125 volts DC, 250 volt AC—1, 2, 3, 4, 5 and 6 pole. 60 amperes, 250 and 600 volts—3, 4 and 5 pole. 100 ampere, 250 and 600 volts—2, 3 and 4 pole. Also many special types, fusible and fuseless, for varied applications.**

*TRADEMARK REG. U. S. PAT. OFF.

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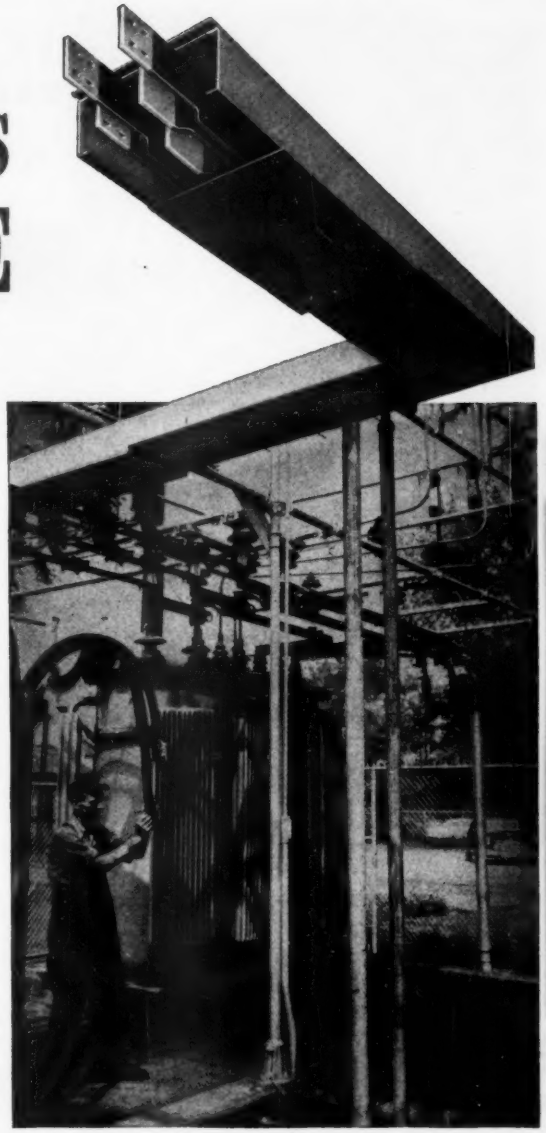
BUS DUCT IS FLEXIBLE



Modernize now or you may have to improvise later

Pound for pound, Westinghouse Bus Duct delivers more power than comparably rated systems of wiring, cable or conduit. And—the longer the run, the greater the saving.

As one large manufacturer in the metal working industry said: "We found a tremendous saving in the materials purchased, to say nothing of the far lower labor cost for installation. Wire and conduit alone would have exceeded the cost of the Westinghouse Bus Duct installation. We also found in Westinghouse Bus Duct the flexibility we just had to have in running power from floor to floor".

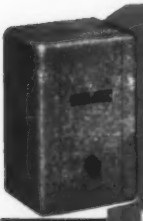
The 4,000-ampere duct illustrated is part of a 1,200-foot system installed with the addition of new automatic machinery to the production line.

Plug-in receptacles every foot of plug-in duct speed machine tie-ins, simplify change-overs or line expansions.

For details on further advantages, call your nearest Westinghouse representative, or write for Manual B-4272-A, Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. J-30061

Westingnouse 4,000-ampere Weatherproof Low-Impedance Bus Duct connected to 480-volt buses of 1,500-kva transformers. 2,400-ampere cables are being disconnected.

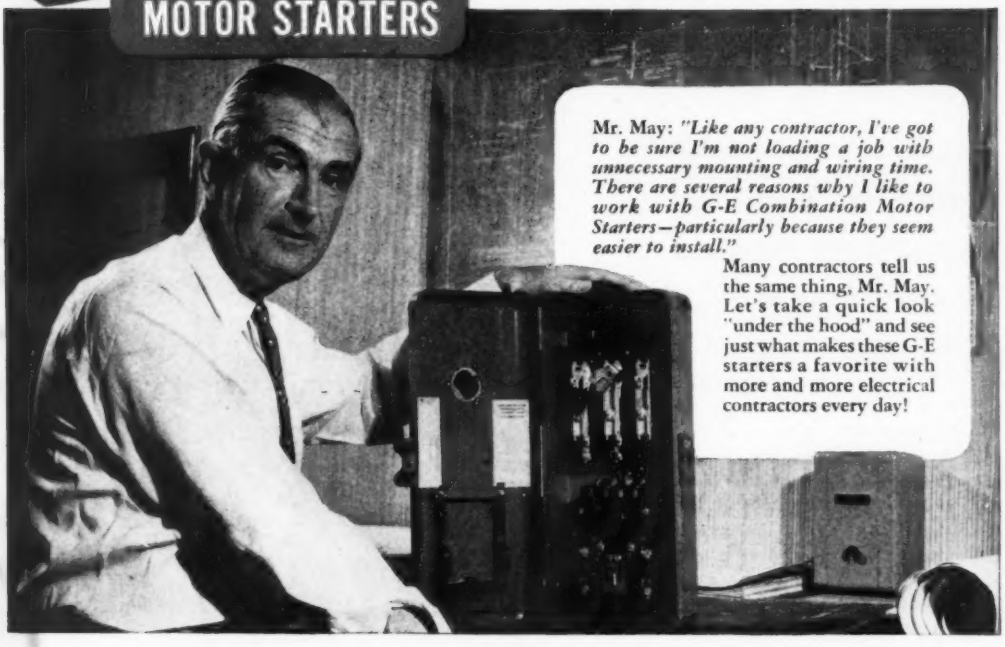
YOU CAN BE SURE.. IF IT'S
Westinghouse
BUS DUCT



COMBINATION MOTOR STARTERS

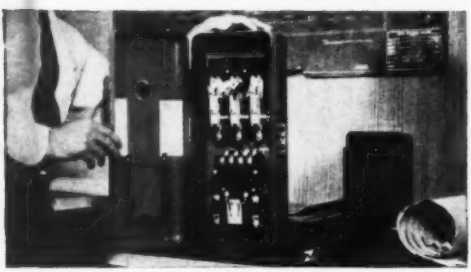
...save wiring

E. G. MAY, ELECTRICAL CONTRACTOR,

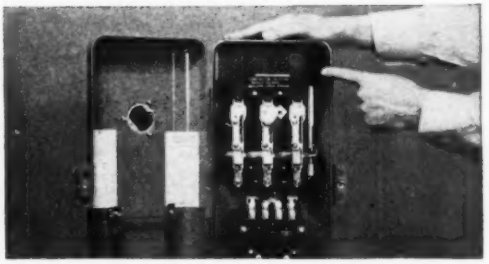


Mr. May: *"Like any contractor, I've got to be sure I'm not loading a job with unnecessary mounting and wiring time. There are several reasons why I like to work with G-E Combination Motor Starters—particularly because they seem easier to install."*

Many contractors tell us the same thing, Mr. May. Let's take a quick look "under the hood" and see just what makes these G-E starters a favorite with more and more electrical contractors every day!



1 Mr. May: *"Suppose we start with the mounting. There's a real time-saver!"*
That's right, Mr. May. Both starter and disconnect switch are mounted in one case. Thus, they're installed as a unit! You save wiring time and your customer gets a neater installation!



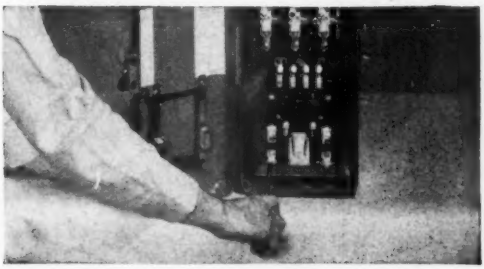
2 Mr. May: *"Wiring room is mighty important to a contractor."*
Then you should like the layout of this starter. There's plenty of room at top and bottom for line and load wiring. Of course, we take care of wiring the disconnect switch to the starter at the factory.

GENERAL ELECTRIC

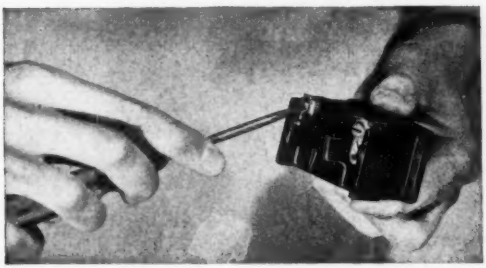
730-24

time for these 4 reasons

REVEALS THE "REASONS WHY" HE PREFERS G-E COMBINATION STARTERS



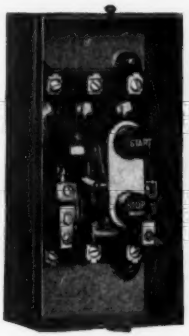
3 Mr. May: *"Having these terminals up front makes them easy to work with!"*
Remember, too, you're working with large pan-head screws. All you do is strip the wires, slide them under the terminal clamps which ride out with the screws, and then tighten. All terminals are big, rugged and permanently anchored.



4 Mr. May: *"I've heard a lot about this coil. What's so different about it?"*
It's completely encased in plastic—so that neither you when installing the starter, nor your customer when servicing it can damage the coil with a slipping screwdriver; and you can assure your customers that these "Strong Box" coils last longer because water, dust and oil are *sealed out!*

G-E Manual Starters ...easier to install, too!

For manual starting of 7½ hp or smaller motors, you can't beat a G-E starter for easy installation, long life. Built to the same rugged specifications as the magnetic starter, it includes many of the same features for quick-wiring:


Front-connected clamp-type terminals up front!
Three-point keyhole mounting.
Plenty of wiring space and straight-through wiring.
Handy knock-outs in top, bottom and sides.

These starters are available with either push-button or toggle-switch operation, and can also be obtained in water-proof, dust-proof, or explosion-proof enclosures . . . 2-, 3-, or 4-pole forms.

G.E. also offers a complete line of control accessories to make operations more automatic . . . more convenient.

BUY ONE AND COMPARE!

Take any G-E motor starter apart and inspect it. See for yourself why G-E starters last longer, cost less to install, and are easier to maintain than any starters you can buy. Your G-E representative or authorized distributor can supply many models of G-E starters in NEMA sizes 0, 1, 2, and 3 for motors up to 50 hp; anticipate your requirements and place your order early. For more information on magnetic starters, write for Bulletin GEA-5153; manual starters, Bulletin GEA-1522. Section 730-24, *General Electric Company, Schenectady 5, N. Y.*

MAGNET WIRE

You'll get superior results and save money with ROEBLING ROEVAR

YOU GET a whole group of special advantages with Roebling Roevar Magnet Wire. For one thing, it doesn't tend to become brittle, crack or lose its toughness when subjected to relatively high operating temperatures. For another, Roevar's insulation has from 10 to 40 times more abrasion resistance than ordinary enamel insulation. It has no equal for high speed winding. And Roevar stretches and bends remarkably without cracking or working loose from the conductor. It has a better-than-average space factor.

A large share of Roebling's complete line of electrical wires and cables is required today in the national rearmament program, but the Roebling organization will always do everything possible to meet your individual service and delivery requirements. John A. Roebling's Sons Company, Trenton 2, New Jersey.

ROEBLING

Atlanta, 934 Avon Ave ★ ***Boston,*** 51 Sleeper St ★ ***Chicago,*** 5525 W. Roosevelt Rd ★ ***Cincinnati,*** 3253 Fredonia Ave ★ ***Cleveland,*** 701 St. Clair Ave, N.E. ★ ***Denver,*** 4801 Jackson St ★ ***Detroit,*** 915 Fisher Building ★ ***Houston,*** 6216 Navigation Blvd ★ ***Los Angeles,*** 216 S. Alameda St ★ ***New York,*** 19 Rector St ★ ***Odessa, Texas,*** 1920 E. 2nd St ★ ***Philadelphia,*** 230 Vine St ★ ***San Francisco,*** 1740 17th St ★ ***Seattle,*** 900 1st Ave, S. ★ ***Tulsa,*** 321 N. Cheyenne St ★ Export Sales Office, ***Trenton, N. J.***

Accessible FOR QUICK INSPECTION!

ALLIS-CHALMERS Type H Starter cubicles are divided into three main compartments to assure quick, easy and safe maintenance checks.

1. **High Voltage Fuse Compartment** — enclosed by an electrically interlocked door which disconnects the load when fuses are exposed.
2. **Low Voltage Compartment** — houses control relays and accessories . . . accessible through a 68" door.
3. **Rear High Voltage Compartment** — all high voltage components are accessible through the full length rear door.

ALLIS-CHALMERS
Type H Starters
FOR 2300 TO 5000 VOLT MOTORS

Contactors, overload relays, short circuit fuses . . . everything you need for complete control of your motors is readily accessible in the attractive, easy to install steel cabinet of a Type H Starter.

For full or reduced voltage starting, reversing or dynamic braking of squirrel-cage, wound rotor and synchronous motors . . . Allis-Chalmers Type H Starters will be your right answer. They are engineered for dependability, designed for ready access, and built to give long life with low maintenance. Call your nearby A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin for bulletin 14B6410A. A-3349

MAXIMUM HORSEPOWER

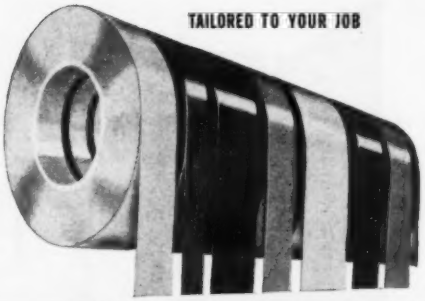
	AIR CONTACTOR		OIL CONTACTOR	
2000-2500 VOLTS	Synchronous		Synchronous	
	1.0 PF	.8 PF	1.0 PF	.8 PF
	1500	1250	800	700
	Induction 1250		Induction 700	
4000-5000 VOLTS	Synchronous		Synchronous	
	1.0 PF	.8 PF	1.0 PF	.8 PF
	2500	2250	800	700
	Induction 2250		Induction 700	

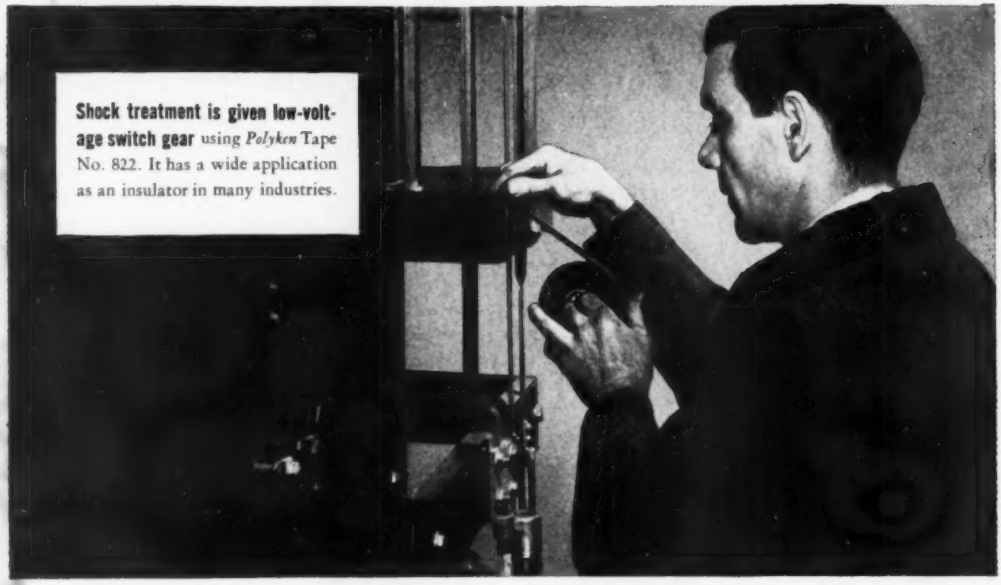
Specify the Type 256 Air Break Contactor, shown in the starter at left, for tough, repetitive duty and long contact life . . . Type MO Oil Immersed Contactor for normal starting duty or for service in dust laden, corrosive or very moist atmospheres.

ALLIS-CHALMERS

A-C ALLIS CHALMERS

THE NEW Polyken® INDUSTRIAL TAPES





Shock treatment is given low-voltage switch gear using *Polyken* Tape No. 822. It has a wide application as an insulator in many industries.

$$\frac{822}{10{,}000} = 0$$

This formula is a long way from scientific, but right on the button when translated. It means that *Polyken* Industrial Tape No. 822, over 10,000 volts, equals no shocks, no corrosion. Although the picture above shows a low-voltage application, No. 822 gives equally good high-voltage protection.

Polyken No. 822 is a polyethylene plastic-backed pressure sensitive tape. It is only 9 mils in thickness, yet with its polyethylene backing, has a dielectric strength of 10,000 volts, a power factor of .005 and insulation resistance of 106 megohms.

It has a moisture vapor transmission rate of 0.25 grams per 100 square inches for 24 hours at 80°C. This means that *Polyken* No. 822 provides excellent protection against corrosion of switch gear parts exposed to moisture or salt and chemical-laden air. Because of the elastic properties of polyethylene it will conform to odd-shaped surfaces.

A few seconds' thought will probably bring to mind some applications for this tape in your plant. Our engineers will be glad to discuss them with you . . . no obligation, of course.

FREE SAMPLES. Write today for complete engineering data, plus samples of *Polyken* No. 822. Address *Polyken*, Dept. ECH, 222 West Adams Street, Chicago 6, Illinois.

***Polyken* Industrial Tape, Department of Bauer & Black, Division of The Kendall Company**

RECORD *Mass Production!*
NEW *Lower Price!*

For **UNION Conduit End** *Bushings!*

Added Protection At Lower Cost!

SIZES
1/8" to 6"

Mass production wins again! The new high in production of Union's Conduit End Bushings now makes possible substantial savings in wiring with Insulated Bushings.

Since section 3736-B of the 1951 N.E.C. virtually specifies insulated bushings where No. 4 wire or larger is installed in conduit, Union's Insulated Conduit End Bushings have become standard item on Conduit wiring jobs.

Contractors can depend on Insulated bushings for their extra protection and safety without the deterrent of higher bushing costs.

In sizes 1¼" and up where strength counts, be sure you **SEE THE CANVAS.** Then you know that no substitution of a weaker material can be made.

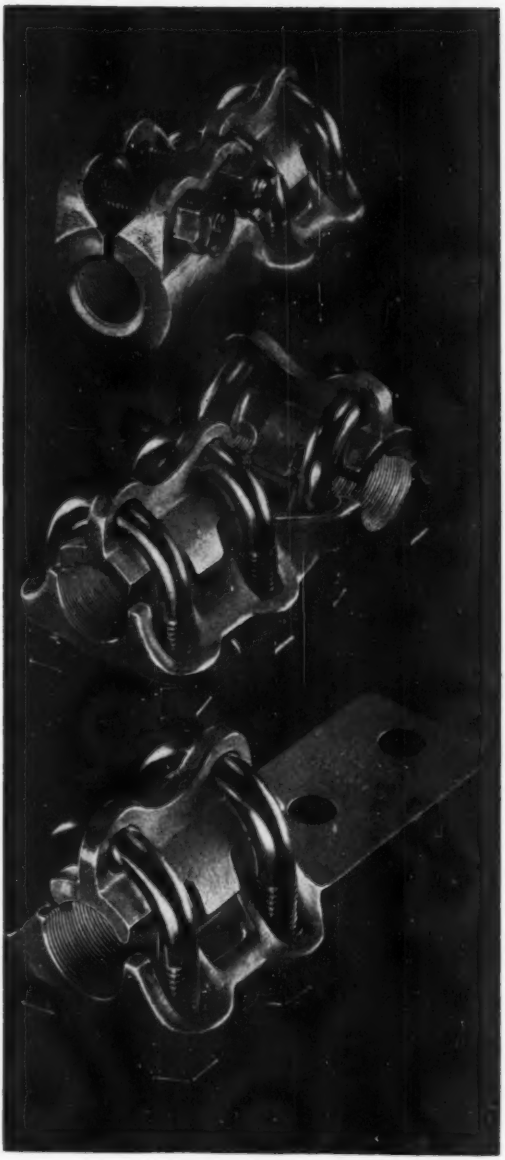
UNION INSULATING CO.

PARKERSBURG, WEST VIRGINIA

Low joint resistance . . . high resistance to corrosion

POWER CONNECTORS

Silver plated on all contact surfaces!



Silver on all current-carrying surfaces is just one of the ways in which G-E power connectors reduce joint resistance and minimize corrosion. Carefully regulated copper content of connector alloy provides current-carrying ability equal to that of conductor. Sharp, machine-serrated contact surfaces bite into the conductor, giving a permanent high conductivity joint that resists vibration and maintains positive pressure at all times. Interlocking sides confine the strands of the cable within the enclosure, reducing inter-strand resistance and taking full advantage of the cable's current-carrying capacity. Non-corrodible hardware of high-strength bronze alloy assures permanent tightness of connections.

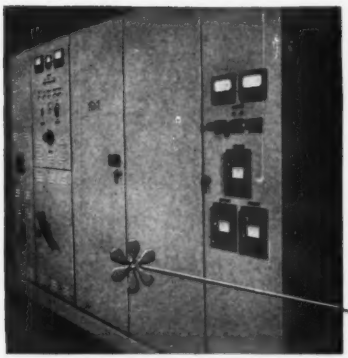
There's a wide range of types—straight, tee, block, angle, parallel, expansion, ground, and many others. Why not place a trial order with your G-E sales representative? Write for Bulletin GEC-400—it contains 44 pages of valuable connector information. Section 856-57, General Electric Company, Schenectady 5, N. Y.

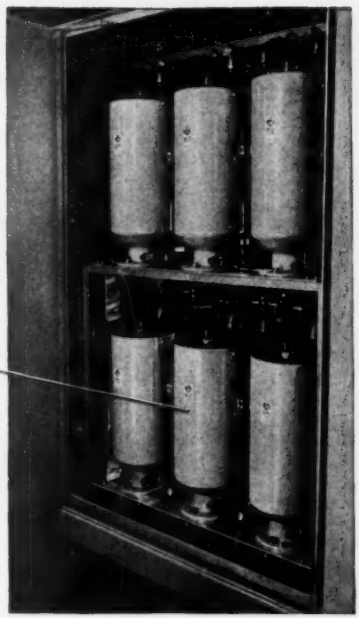
856-57

GENERAL ELECTRIC

Don't build around obsolete DC supply

—RETIRE IT NOW!





Modern Allis-Chalmers factory packaged, sealed tube, 500 kw mercury arc rectifier as installed in midwestern industrial plant. Left: "dead-front" compartments for dc feeders, dc metering and cathode breaker, rectifier tubes, and ac control and metering. Right: interior view of mercury arc rectifier tube compartment.

NOW IS THE TIME to retire obsolete converting and generating equipment. As operations expand, this inadequate equipment will become a growing handicap.

Now too — while there is a favorable base for amortization — is the time to consider mercury arc rectifiers for your expansion plans. Let Allis-Chalmers show you how the *modern* mercury arc rectifier can improve your direct current service.

LOW MANPOWER REQUIREMENT. With push-button starting and no synchronizing required, attendants are not needed during normal operation. Downtime for maintenance is reduced with no moving parts to lubricate or wear.

LOW COST OPERATION. Conversion efficiency is higher at all loads with large power savings during light load periods.

CONVENIENT INSTALLATION. Factory packaged, light in weight, and requiring no special foundation, Allis-Chalmers mercury arc rectifiers may be placed right at the load center.

IMPROVED PLANT OPERATION. With dc load center installation, distribution distances are cut, dc feeder losses are reduced, and full voltage is available at production equipment.

Whatever your specific direct current needs, Allis-Chalmers builds suitable and truly modern mercury arc rectifiers to meet them.

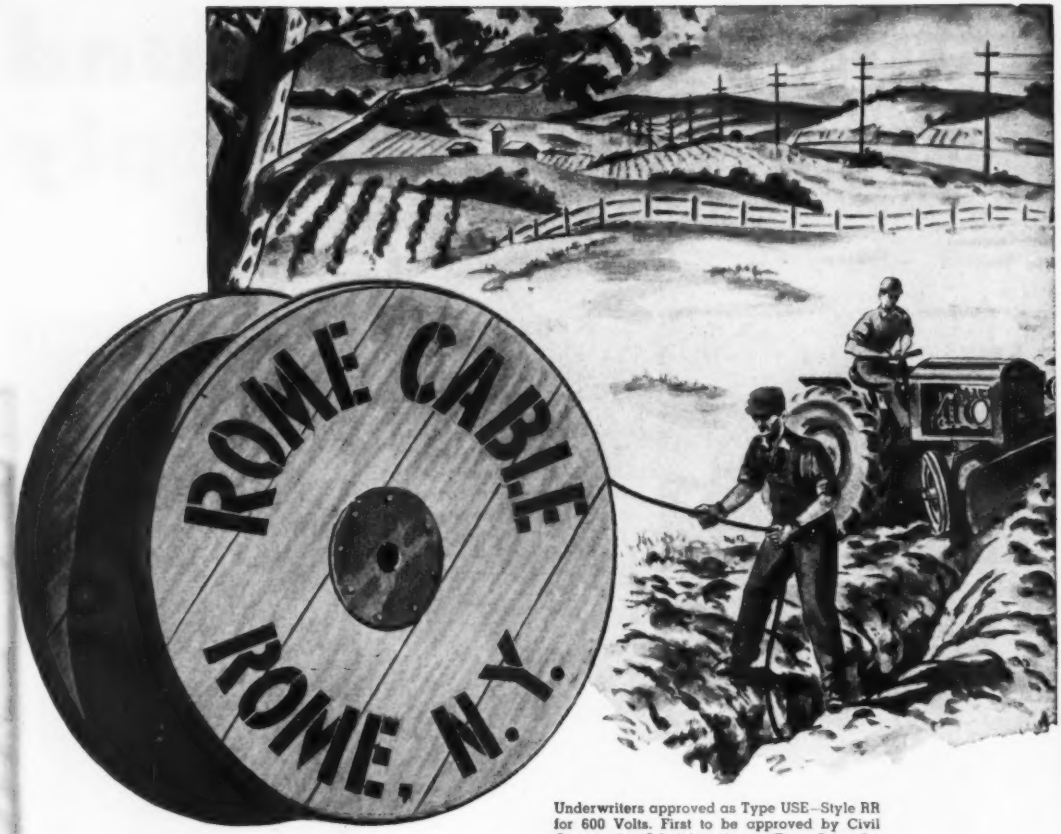
Sealed tube rectifiers (as shown above) are supplied in ratings from 200 to 1000 kw for lighter duty service. These are commonly used in large buildings, industrial plants and electric haulage systems. Pump evacuated rectifiers are built from 750 kw to the largest ratings required for heavy duty applications.

An Allis-Chalmers representative will be glad to explain in detail how these modern mercury arc rectifiers will improve the operation of *your* direct current system. Call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

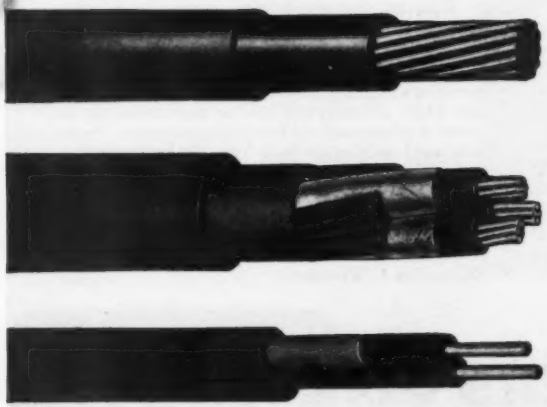
A-3467

ALLIS-CHALMERS A-C

MERCURY ARC RECTIFIERS



Underwriters approved as Type USE–Style RR for 600 Volts. First to be approved by Civil Aeronautics Administration as Type A insulation for airport wiring under Specification L-824.



RECOMMENDED FOR

DIRECT EARTH BURIAL

OVERHEAD

IN CONDUIT

APPROVED FOR DIRECT EARTH BURIAL

RoMarine - RoPrene

TYPE USE, STYLE RR

ALL-PURPOSE POWER CABLE

RoBarn—For Farm and General Purpose Wiring

• Underwriters approved as Non-Metallic Sheathed Cable, Ro-Barn is the *safe* barn wiring material. Neoprene insulated and sheathed, it will not mold, rot, or oxidize. It is completely resistant to chemical fumes and is unaffected by the extreme temperatures and humidity of livestock buildings . . . Developed primarily for the farm, RoBarn is ideally suited to any general purpose wiring where comparable hazards exist. Write for descriptive folder.

Rome Keeps Your Customers Sold by Aggressive National Advertising

Special Wholesalers Packaged Weatherproof Wire

Here is a special 500 foot carton package of Weatherproof for handy contractor use. Originated by Rome for small outdoor jobs, this convenient package eliminates waste and cuts costs. Available in sizes 4 to 14 AWG, soft and medium hard.

SAVES LEAD . . . COSTS LESS . . . EASIER TO HANDLE

RoMarine-RoPrene is the modern all-purpose power distribution cable.

Versatile in application, RoMarine-RoPrene is one cable suitable for direct earth burial, installation in air, in conduit, or *for circuits combining all three.* The RoMarine insulation affords resistance to heat and moisture. The RoPrene (Neoprene) sheath is highly resistant to oils, acids, alkalies, corrosive fumes, flame and abrasion. It is unaffected by electrolysis, weather hazards or extreme temperature change. Its fast growing popularity proves its dependability.

Having a non-metallic sheath, RoMarine-RoPrene saves critically short lead . . . costs less than lead sheath cable . . . is lighter . . . easier to handle, tap and splice.

For secondary network circuits, farm electrification, airports, industrial and commercial modernization, as well as residential services, you can recommend RoMarine-RoPrene with confidence that it is the *right* cable and the *best* cable for the job.

Descriptive Bulletin RR-1 will be mailed upon request.

Copper wire mill products are a Controlled Material under N. P. A. Controlled Materials Plan . . . USE YOUR CMP ALLOTMENTS.

It Costs Less To Buy The Best

ROME CABLE CORP., Dept. ECM8, Rome, N. Y.
Please send Bulletin RR-1.

Name.....

Company.....

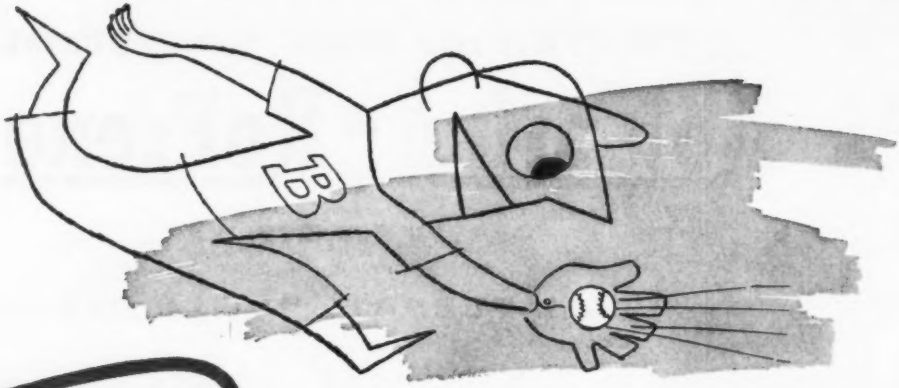
Address.....

City.....*State*.....

ROME CABLE
Corporation
ROME • NEW YORK
From Bar to Finished Wire

ROME CABLE ROME, N.Y.

Are you UP on grounding?



THE ANSWER IS BRYANT

WITH BRYANT 3-WIRE GROUNDING DEVICES

For the grounding of exposed metal parts of portable appliances and electrical equipment, these devices protect against the hazards of electrical shock. They may be used with either metallic or non-metallic wiring systems. These devices comply with the requirements of the National Electrical Code, and their use is being specified where grounding is desirable. These Bryant grounding devices may also be used in the conventional manner with standard 2-pole parallel blade caps. Rating 15 amperes, 125 volts.

Listed as Standard by Underwriters' Laboratories, Inc.

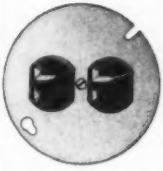
HERE ARE THREE FROM THE COMPLETE LINE →

3-wire
CONVENIENCE OUTLET
No. 5262
Duplex, Brown
No. 5262-I Ivory

All bakelite construction, washer type plaster ears, large terminal binding screws. Side wired.

WEATHERPROOF OUTLET
No. 5260 Single

Has weatherproof gasket between outlet and corrosion-resistant flush plate, and a weatherproof thread-on cover.



BOX MOUNTING OUTLET
No. 5282
Duplex, Brown

Corrosion-resistant cover. For 4 inch boxes.

BRYANT
SUPERIOR WIRING DEVICES

SPECIFY BRYANT DEVICES FROM YOUR ELECTRICAL DISTRIBUTOR

THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut

CHICAGO • LOS ANGELES

J-99858

NOW! G-E BALLASTS ARE SOUND RATED*

*SOUND-RATING: **G. E.'s new classification of ballasts to guide you in the correct application of fluorescent fixtures.**

HOW G-E SOUND RATING WORKS

IF THIS IS YOUR APPLICATION . . .	. . . AND YOUR AVERAGE AMBIENT NOISE LEVEL IS HERE* . . .	USE A BALLAST WITH THIS SOUND RATING
Broadcast Studio Church Country Residence	20-24 decibels	A
Evening School City Residence Quiet Office	26-30 decibels	B
Average Residence Public Library Study Hall	32-36 decibels	C
Classroom Professional Office	38-42 decibels	D
Noisy Residence Business Office	44-48 decibels	E
Store Noisy Office Factories	50-62 decibels	F

*Average ambient noise levels in decibels, measured with standard 40-decibel weighting network.

A new tool to help you build greater customer satisfaction by minimizing noise complaints

Every fluorescent ballast has a normal, magnetic hum. But now, for the first time, you can know the relative sound level of the ballast before you buy. For G-E engineers have pioneered a system for measuring ballast sound levels accurately. These measurements have led to six classifications: from "A"—extremely quiet, to "F"—quite audible. This means that you know, before installation, which ballasts are right for any given application—whether it be church, school, noisy factory area, or any one of a wide range of other locations.

Take the first step toward eliminating customer complaints about objectionable noise. Write for GEA-5672, a four-page bulletin which explains Sound Rating in detail. A reprint of recent technical information (GER-36) is also available. Write Section 412-93, *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

412-93

ADVERTISEMENT

BIDDLE
Instrument News

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

NUMBER 8 OF A SERIES

JAMES G. BIDDLE CO., 1316 ARCH ST., PHILADELPHIA 7, PA.

MOTOR DRIVEN "MEGGER®" INSULATION TESTERS

Ranges up to 50,000 megohms at 2500 volts D-C.

USES

1. Where a number of tests are made at one location, as in testing separate conductors in telephone cable.
2. For dielectric absorption measurements on the insulation of generators, transformers and cables.
3. Where high resistance values need to be measured continuously, such as for indicating the moisture content of paper in production.
4. As a convenient source of low energy test potential at comparatively high d-c voltages.

Motor-driven "Megger" Sets are simple to operate, direct-readings by pointer deflection, rugged and portable; and they are of sufficient range and accuracy for most practical purposes.

DESCRIPTION

The motor-driven "Megger" Insulation Tester is similar to the well-known hand-operated set except that the d-c generator is driven by a motor which can be connected to a convenient outlet.

The generators in motor-driven sets have bearings and other features properly designed for motor operation. They are for continuous, or 24-hour duty. The driving motors which are rubber-mounted to reduce vibration are usually rated 1/20 hp, 115 volts, 60 cps. Other voltage and frequency ratings can be supplied.

The motor and its supporting bracket can be removed quite easily from the instrument case and the set made available for hand operation where an external source of current may not be available. This change can be made in the field.

For complete information write for *Bulletin 21-20-ECM.*

Photo courtesy Philadelphia Electric Co.

ELECTRICAL MEN IN INDUSTRY PREFER THIS DEPENDABLE AND RUGGED INSULATION TESTER

For average industrial requirements the Meg type of Megger® Insulation Tester is by far the most popular set we supply. This incomparable "trouble shooter" has ranges up to 2000 megohms with hand generators up to 1000 volts d-c. It is also supplied with a plug-in rectifier power supply either instead of or in addition to the hand generator.

The performance and endurance records which these instruments have achieved are difficult, if not impossible, to match in any type of portable testing device. For insulation resistance measurements—"Megger" instruments are the recognized standard.

Anyone can measure electrical insulation resistance in generators, motors, wiring and other electrical equipment with a Megger instrument—quickly—easily. Simply make connections, turn the crank and read the position of the pointer on the scale—no dependence on batteries or other source of test current; the built-in generator is always a ready and dependable source of supply.

Learn more about these "indispensable" tools today by writing for *Bulletin 21-45-ECM.*

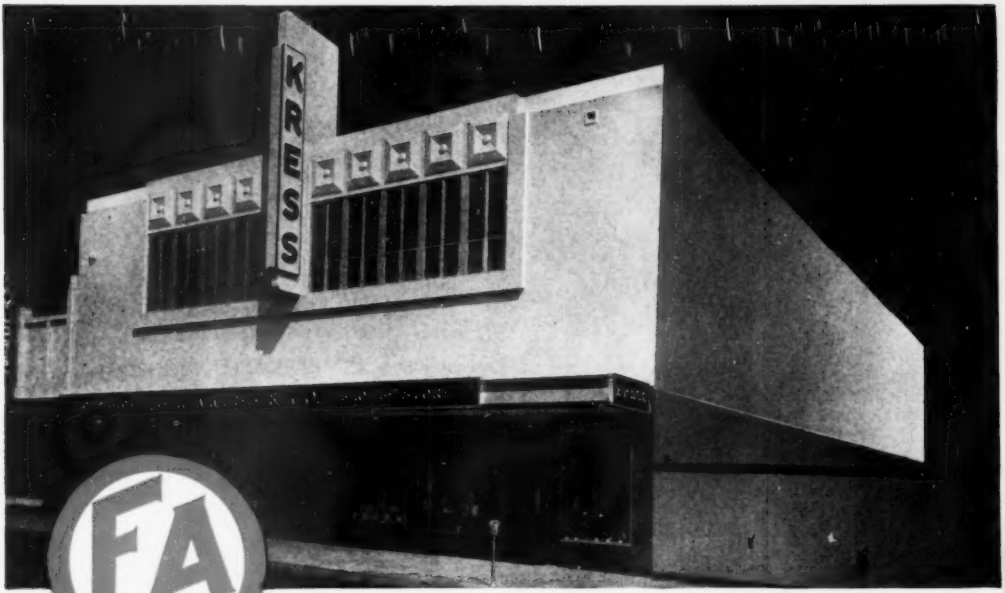
HERE'S A "GOOD COMPANIONS" KIT FOR PRACTICAL ELECTRICAL ENGINEERS AND MAINTENANCE MEN

Men concerned with all-around-the-plant electrical tests and resistance measurements tell us that these are "indispensable" tools:

Midget Megger® Insulation Tester for detecting dirt, moisture and deterioration in advance of failure, or as a trouble-shooter after failures occur.

The Midget Megger Circuit Testing Ohmmeter for measuring conductor resistance of coils, contacts and relays, and checking continuity of circuit and grounded parts.

Be sure to write for your copy of 21-85-ECM today.



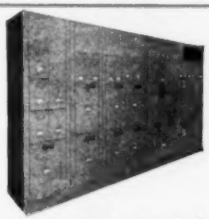
S. H. KRESS STORE *at Santa Monica, Calif. designed by Company's Architectural and Engineering Department*

FA PRODUCTS provide dependable Power and Light Service for this Modern Store . . .

Adequate Light and Power is an extremely important ingredient of modern merchandising. Recognizing this, more and more architects, engineers, contractors and others are specifying FA electrical products for both new and modernized buildings.

For more than 60 years, FA has been specializing in the design and manufacture of electrical products for industrial, commercial, institutional and residential use . . . products that are modern in design, of rugged construction, easy to install, safe and dependable in performance, longer lasting and require less maintenance.

There's a FA unit for almost every power and light distribution problem. You can be sure of safe, dependable and trouble-free service by insisting on FA products on your next job. Write today for additional information or contact your nearest FA representative, listed in Sweet's.



The main switchboard installed in the S. H. Kress Santa Monica Store is of the FA Klampswitchfuz type of special design to meet unique requirements of the local Power Company. Illustrated is a typical FA Klampswitchfuz switchboard, features of which are almost unlimited electrical capacity . . . greater operating efficiency . . . less maintenance . . . safer operation with dead front safety type enclosures and safer and more efficient switching with the FA Klampswitchfuz or Snufarc (hinged, pull out) switches.

Capacities: FA Klampswitchfuz 30 to 600 amps., 250 volts AC or DC; FA Snufarc 30 to 200 amps., 600 volts in 2, 3 and 4 poles.

FA LNTIP Type Panelboard installed in S. H. Kress Santa Monica Store. A safety-type panelboard, this unit combines single pole plug fuse with heavy duty tumbler switch into a four circuit standardized section.

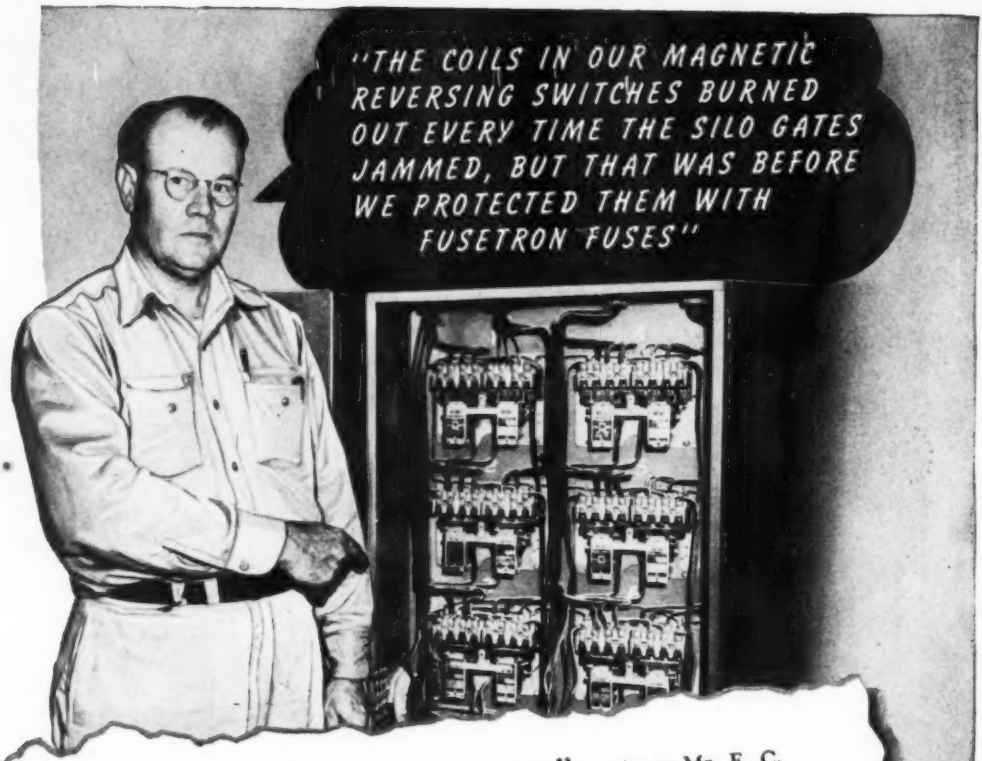
Capacities: 30 amperes, 250 volts, 4 to 40 branches, for 3 or 4 wire — solid neutral mains.

Frank Adam Electric Co.

P. O. BOX 357 ST. LOUIS 3, MO.

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

Our 60th Year


"THE COILS IN OUR MAGNETIC REVERSING SWITCHES BURNED OUT EVERY TIME THE SILO GATES JAMMED, BUT THAT WAS BEFORE WE PROTECTED THEM WITH FUSETRON FUSES"

"Sure! *you can quote me,"* continues Mr. E. C. Willy, Chief Electrician, H. J. Kaiser Co., Radum Plant, Pleasanton, Calif.

"In the past, we found magnetic reversing switches welded the main contacts when Silo Gates jammed. When reverse control operated, the armature could not properly engage, resulting in a burned out coil.

"The coils cost about $4.00 each, but most important was the substantial production loss each time the coil burned out.

"We now have 4/10 ampere Fusetron dual-element fuses installed to protect these coils. During the year 1950 we blew about 100 Fusetron fuses, but didn't lose any coils. This represents a saving of at least $400.00 in coils and kept me from being dragged out of bed at night, an occurrence that often happened before. Then, too, we can replace burned out Fusetron fuses much faster than we can replace coils, to say nothing of the valuable production time we save."

Facts about Fusetron *dual-element* Fuses

- The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.
- They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.
- Made to the same dimensions as ordinary fuses — fit all standard fuse holders.
- Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.
- Their cost is surprisingly low.

FUSETRON

TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION

BUSS

"You too, can get 10 Point Protection by using Fusetron (DUAL-ELEMENT) Fuses"

1* Protect against short-circuits.

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.

4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money — permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

★ Fusetron Fuses have high interrupting capacity as shown by tests of Electrical Testing Laboratories of New York City in December 1947.

Don't Risk Losses!

One **destroyed** switch or panel . . .
One **needless** shutdown . . .
One **lost** motor . . .

May cost you far more than replacing every ordinary fuse with a Fusetron dual-element Fuse.

Mail the Coupon Now!

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

Name_____

Title_____

Company_____

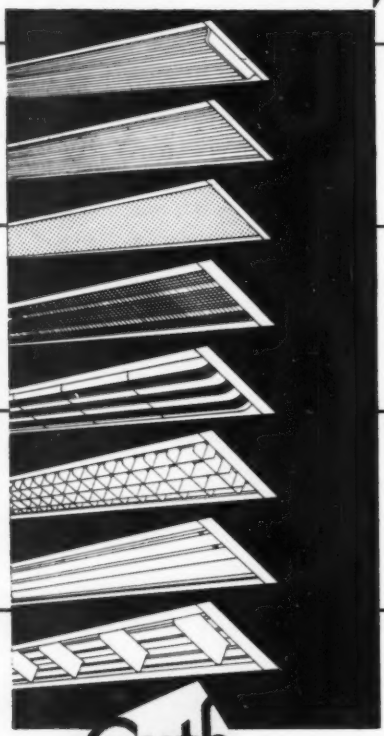
Address_____

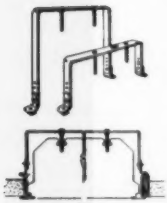
City and Zone_____ State_____ ECM 8-51

"Guth ....Tops in Troffers!"

Our customers have sold us on our troffer line! They say: "It's Number One everywhere — in quality, comprehensiveness, and price. It's great!"

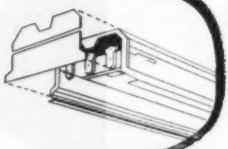
Look how easy it is to install and maintain GUTH Troffers:





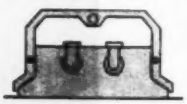
SIMPLE, ONE-MAN INSTALLATION

place the exclusive GUTH QM brackets in the ceiling. Then one man can push the Troffer into place. Brackets grip the Troffer automatically, allowing it to be adjusted for perfect fit and fastened with wing nuts. That's all — simple, isn't it?



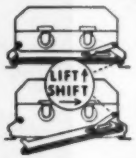
MODULAR LENGTHS WITHOUT TRIMMING

Troffers fit ceiling block openings in lengths of 2', 4', 5', 6', and 8'.



WIDE OPEN WIREWAY

wires are pulled through quickly and easily. How the contractor loves this feature!



MONEY-SAVING MAINTENANCE

glass framed and eggcrates are hinged for easy relamping and cleaning. Slide-in reflectors are easy to remove and replace — no latches or nuts to bother with. Ballast can be replaced without removing fixture.

UNBROKEN RIBBONS OF LIGHT

no metal joints — no divider shadows.

1-, 2-, 3- AND 4-LAMP SIZES

all with the same cross section — may be combined for perfect fit in one "strip".

ALL POPULAR LIGHT SOURCES

top lighting efficiency with Standard, Slimline, and Low Brightness lamps — in a total of 24 wattage sizes.

Write for Bulletin 869-A.

Guth LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting since 1902

Washington Report

Defense complacency is gaining momentum. This letdown is due partly to Korean cease-fire negotiations, partly to the question of whether the present mobilization program and all that goes with it is necessary.

But officially, Truman and the military are urging even greater mobilization effort. Truman wants further economic controls, allegedly to curb growing inflationary pressures. He wants to double arms spending next year, and the military wants to up personnel. Congress is not sold. However, prospect is Congress will go along, but with some curtailment of Presidential powers and some cutback in military spending. Another major crisis, even a breakdown of Korean cease-fire talks, would swing Congress in line.

Production controls, now administered by NPA, are expected to be continued in much their present form for another year. Congress' holdout on renewal of the 1950 Defense Production Act reflects controversy with Truman principally over anti-inflation measures—price and wage controls. Need for production controls has been well established and generally accepted.

Metals shortages continue to hamper mobilization plans. Structural steel capacity is inadequate to support industry's huge plant expansion program—4th quarter demand is nearly 2.5-million tons, supply about 1.3-million. NPA will adjust with tighter controls on all construction. Pinch on steel in other shapes is easing gradually. Expanding capacity for aluminum, still tight, is easing this squeeze. Copper remains critical, but CMP is smoothing distribution, forcing further conservation.

New construction first six months of this year totalled nearly $14-billion, up 16% over similar period of 1950. This is a new record, both in dollars and in volume, for any previous year. Boost was due to: industrial—up $740-million; military and naval facilities—up $270-million; and commercial —up $240-million. Residential maintained the same dollar level in spite of higher costs and credit curbs, but physical volume was lower.

Electrical work is increasing by leaps and bounds. This is due principally to two factors: 1) the highest rate on record for new construction, and 2) construction in progress requires more wiring and lighting per dollar of construction than is required by normal construction in a peace economy. Mobilization officials have been slow to recognize this fact, which has resulted in shortages of many electrical wiring products.

An OPS price regulation covering construction industry contractors and subs (including electrical) was considered by an Industry Advisory Committee group and OPS on July 26. Further details were not available up to the time this went to press.

Repair shops may now use a self-allotment procedure to obtain copper wire mill products using an RE allotment symbol, as detailed in CMP Reg. 7, issued July 6, 1951. They may also obtain other materials by applying a DO-RE rating under conditions outlined in the same CMP Reg. 7, or by extending their customers' MRO allotment symbol.

MRO materials and supplies may be obtained by most businesses with an MRO allotment symbol, under provisions outlined in CMP Reg. 5, issued July 6, 1951. CMP Regs. 5 and 7 replace former NPA Reg. 4, now revoked.

Control of wages and salaries of on-site mechanics and laborers will now be covered by a special regulation which has been adopted by the Construction Industry Stabilization Commission and approved by the Wage Stabilization Board.

This bank of 37.5 kva dry-type transformers supplies power to a test panel. Wherever lighting is altered or machines are relocated, "dry-types" can be moved quickly.

Short Cut
TO QUICK PLANT CONVERSION

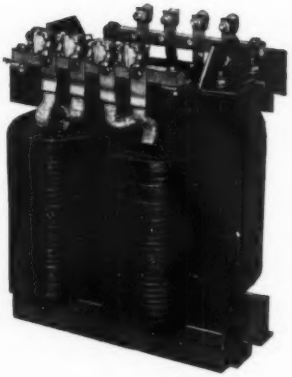
ON THE TEST FLOOR of a large Midwest manufacturer, this bank of 37.5 kva dry-type transformers supplies voltage for accurate switchgear testing. Combinations of 60 and 110 volts up to 2200 volts are used for switchgear durability, rupture, life and heat tests. But in spite of almost continuous service since November, 1942, the transformers required virtually no maintenance.

As this company found, the light, portable Allis-Chalmers dry-type transformer is a convenient means of putting power close to the load without loss of time or trouble. Because it speeds changeovers on lighting and power services, it prevents costly delays in supplying correct voltage to lighting, motors or heating equipment. At the same time it eliminates long, expensive secondary feeders and hard-to-get copper.

That's why the A-C dry-type transformer can help in making emergency rearrangements of plant layout or of spotting power for relocated machines. The Allis-Chalmers dry-type transformer is easy to install. Solderless connectors on popular sizes reduce hook up time to minutes.

Allis-Chalmers general purpose dry-type transformers are built in single phase sizes — 200 kva and smaller; three phase sizes — 300 kva and smaller, 600 volts and below. For more information consult your A-C sales office, or write Allis-Chalmers, Milwaukee 1, Wisconsin, for bulletin 61B6382A.

A-3441



ALLIS-CHALMERS

AUGUST .... at a Glance

Missouri Flood

Flood ravaged industries in the Kansas City area, under silt laden water for days, present a major job to the electrical industry of that region. Contractors, motor shops and wholesalers have organized for maximum effectiveness of available material, manpower and equipment resources for the restoration.

Middlewest Editor, August Eckel, on a field trip through Tennessee and West Virginia, parked his car in Knoxville, cancelled his appointments and caught a plane to Kansas City to provide us with an expert on-the-spot report of electrical activities there. His first story, telegraphed to beat the deadline of this issue, is our lead news story on page 113.

A picture story of the kind of electrical problems encountered and the way they are handled in the flood emergency will be ready for our next issue in September.

Electric Ceilings

A newly designed troffer beam doubles as a structure member and mounting facility for fluorescent lighting fixtures in a new specially designed integrated ceiling lighting system. Fixtures can be located in the trough in any one-foot module. This new system is described in "Integrated Ceiling Lighting", beginning on page 45.

Relay Switching

Since the introduction of the fluorescent lamp, there have been many systems installed taking advantage of the high voltage circuits that are practical with fluorescent lighting equipment. One of the problems encountered on such installations, however, is local switching of individual lighting fixtures, or groups of fixtures. The relay switch has been adapted to such use with good results. Relays with contacts rated at 277 volts isolate the high voltage from the control point which operates at 25 volts. This method indicates the probability of more extensive use of 480/277 volt lighting circuits in commercial and office buildings. It is described in "277 Volt Relay Switching" by H. H. Watson, beginning on page 38.

X-Ray Power

X-ray apparatus and industrial radiographic machines require comparatively heavy currents for brief time intervals. Effective operation of the equipment depends upon good voltage regulation in the supply, distribution, and branch circuits. Walter S. Lusby, in "Power For X-Ray" on page 40, presents an appraisal of the special requirements for power supply for both industrial and medical x-ray apparatus, which will provide useful data for all concerned in the design of wiring systems which serve this kind of equipment.

Battery Care

With growing shortages of strategic materials, the care of industrial truck batteries becomes an increasingly important function of the electrical maintenance department. K. A. Vaughan in "How to Take Care of Industrial Truck Batteries", page 46, gives a comprehensive pattern of suggestions and recommendations for their proper handling.

DATES AHEAD

American Institute of Electrical Engineers—Pacific General meeting, Multnomah Hotel, Portland, Oregon, August 20-23.

Illuminating Engineering Society—National Technical Conference, Hotel Shoreham, Washington, D. C., August 27-30.

International Association of Electrical Inspectors — Southwestern Section, Hotel Lafayette, Long Beach, Calif., September 13-15; Northwestern Section, Hotel Davenport, Spokane, Wash., September 19-21; Western Section, Hotel Fontenelle, Omaha, Neb., September 25-27; Eastern Section, Claridge Hotel, Atlantic City, N. J., October 1-3; Southern Section, Hotel John Marshall, Richmond, Va., October 15-17.

International Municipal Signal Association, Inc.—Annual convention, Mark Hopkins Hotel, San Francisco, Calif., Sept. 17-20.

Canadian Electrical Manufacturers Association—General Brock Hotel, Niagara Falls, Ont., September 26-28.

National Farm Electrification Conference — Hotel Gibson, Cincinnati, Ohio, October 9-10.

National Electrical Contractors Association—Annual Convention, Shoreham Hotel, Washington, D. C., October 9-12.

International Association of Electrical Leagues—16th Annual conference, Roosevelt Hotel, New Orleans, La., October 10-13.

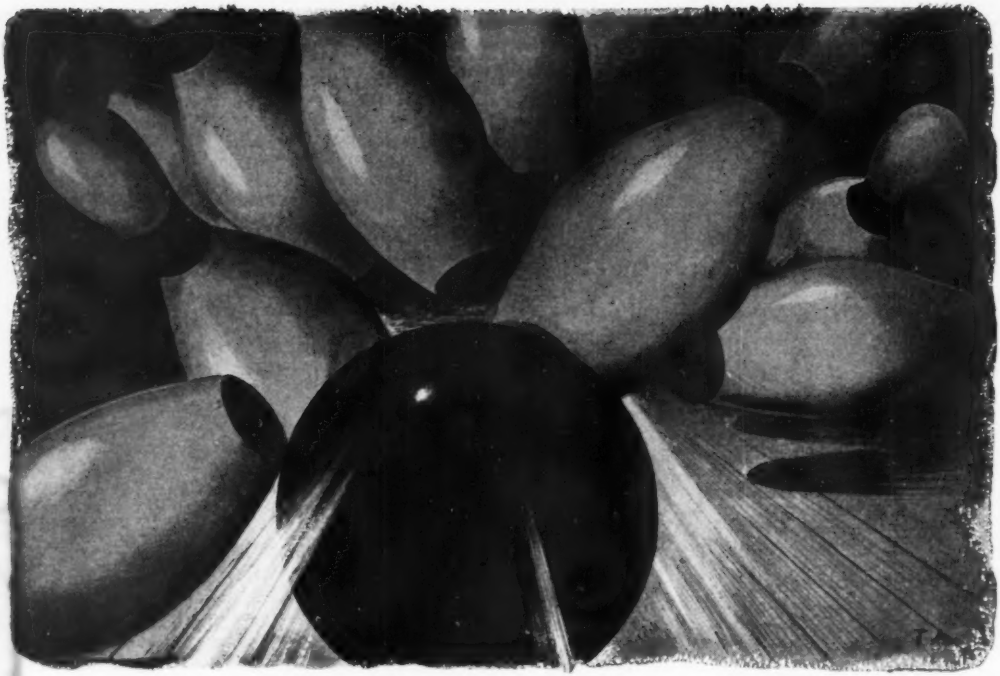
American Institute of Electrical Engineers—Fall general meeting, Hotel Cleveland, Cleveland, Ohio, October 22-26.

National Electrical Manufacturers Association—Haddon Hall, Atlantic City, N. J., November 12-15.

Plant Maintenance Show—Convention Hall, Philadelphia, Pa., January 14-17, 1952.

American Institute of Electrical Engineers—Winter general meeting, Hotel Statler, New York, Jan. 21-25.

4th International Lighting Exposition and Conference—Cleveland Municipal Auditorium, Cleveland, Ohio, May 6-9.



We set 'em up— you knock 'em down!

Join Anaconda's dynamic "Power Up—And Be Prepared" promotion and build your future while you build up industry to strengthen America's defenses.

Anaconda's *"Power Up—And Be Prepared"* national promotion is convincing more industrial leaders every day that America's defensive strength requires full-scale production from all American industry . . . and that full-scale production requires up-to-the-minute plant wiring systems. Start now to demonstrate to your customers that today, not tomorrow, is the time to modernize their plant wiring systems.

Here's all you have to do! Get your free Contractor Sales Kit from your Anaconda wholesaler. It contains direct mail pieces, booklets, letters, sales helps and your copy of *"Power Up—And Be Prepared"*— a complete guide to maintaining modern wiring systems.

It's Industry's job to power up and be prepared— it's your job to help them do it. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

the right cable for the job **ANACONDA®** **WIRE AND CABLE**

ELECTRICAL CONSTRUCTION AND MAINTENANCE

50th Year —AUGUST • 1951

Flood Damage Restoration

THE WORST FLOOD in 100 years struck along the Missouri River last month. In the Kansas City surroundings many low lying industrial areas were under 10 to 20 feet of silt laden water for days. As the waters receded, the enormous task of rehabilitation started. It is still going on. From the scene of activity, Middlewest Editor, August Eckel, describes it in a news story on page 113.

ELECTRICAL SYSTEMS are particularly sensitive to flood damage. Lines are torn down and washed away. Conduits are filled with water. Panelboards and controls are covered with mud. Motors are soaked and loaded with grit. Restoration of light and power is a slow process which requires the skill of expert electricians working under experienced management.

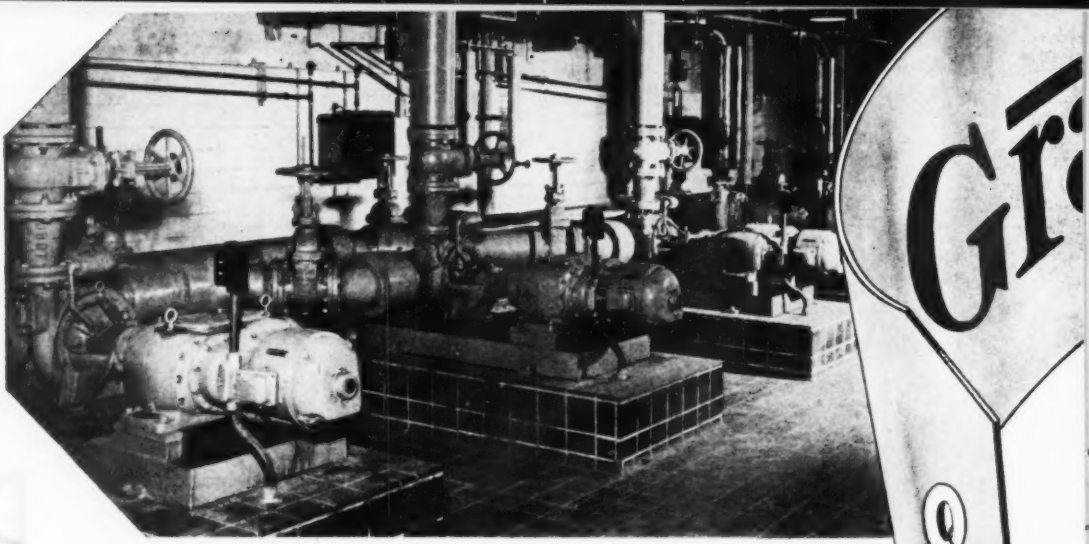
MUCH OF THE EQUIPMENT, under expert handling, can be restored to normal condition and safely returned to useful service. Some of the wiring will have to be entirely replaced and temporary installations may have to serve for many weeks until materials and manpower are available for permanent restoration.

THE ORGANIZATION of the electrical construction and repair facilities of the area has been one of the greatest tests of industry cooperation and initiative in recent years. Special directives from NPA have given top priority to requests for materials destined for flood damage restoration. Offers of materials, manpower and equipment have poured in from electrical contractors, motor shops, wholesalers, utilities and manufacturers from hundreds of miles around the stricken area.

SHORTAGES OF SOME MATERIALS in other parts of the country are going to be aggravated by the requirements for Kansas City. Few will complain. The needs are urgent and deserve first call on available resources.

TO THE ELECTRICAL MEN of the area great credit is due for the way they have met the challenge of a formidable job. They deserve every help and assistance within the power of our industry to provide. We can all take pride in their achievement. They have brought honor and distinction to the whole industry. They are themselves, probably, too busy or too tired to comprehend the greatness of their work.

William T. Stuart



It's sound practice to specify G-E motors—sound practice, too, to make sure you get the *right* General Electric motor for the job . . . via Graybar.

Service under all conditions proves the rugged reliability of the entire G-E Tri-Clad line—motors that are built to take a physical beating . . . built to deliver smooth, steady power *when* and *where* you need it.

Let Graybar be your motor advisor. Your local Graybar Representative can help you match up motors with customer's machine-drive requirements . . . help you analyze special installations requiring totally-enclosed motors, variable speed motors, gear motors, or reversible motors.

He can also provide details on the G-E Motor Exchange Plan. Covering popular fractional and integral ratings, this plan makes emergency replacement of inoperable motors a simple over-the-counter transaction.

When production needs more motor horsepower—

Look behind the Graybar tag

G-E quality plus Graybar service. Graybar distributes G-E controls to match the operating conditions of an motor. A Graybar Power Apparatus Specialist will be glad to recommend the type that's best for any installation.

Before you buy another motor — or for that matter, anything electrical — discover for yourself the many helpful services that stand behind the Graybar tag — services that even today can help you buy with greater speed and efficiency.

A network of over 100 offices and warehouses places Graybar facilities conveniently close-at-hand — regardless of your location.

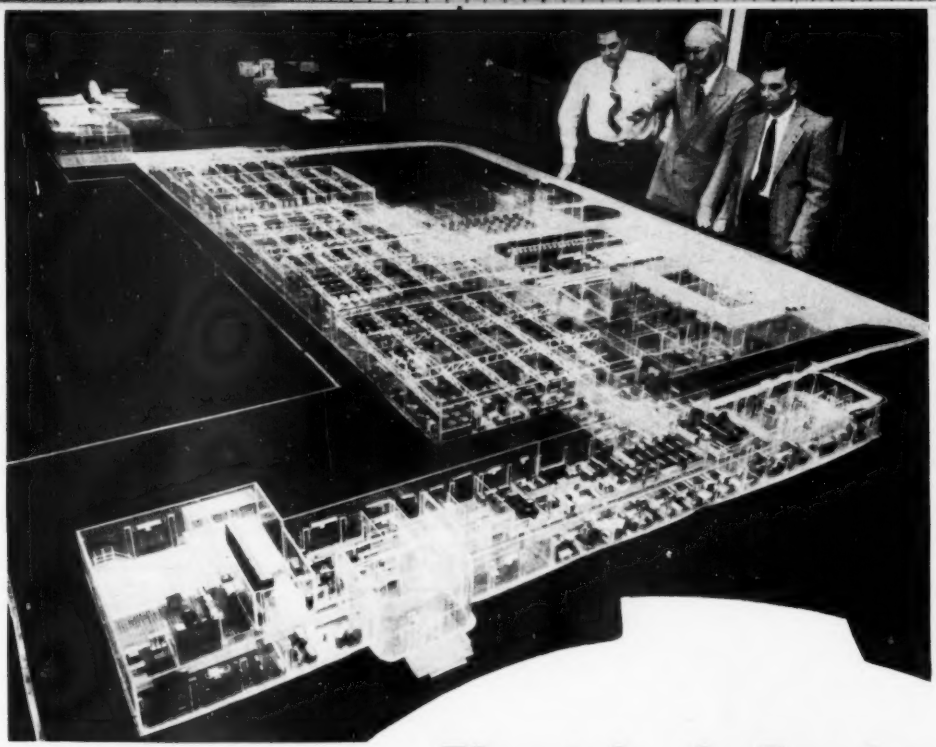
Local Graybar Representatives can furnish you and your customers with practical advice on the installation and usage of most every-day electrical items. On out-of-the-ordinary installations or where you desire specialized technical information you can get the additional assistance of experienced Graybar Specialists.

Your near-by Graybar office also maintains a comprehensive information service covering all of the more than 100,000 electrical items distributed by Graybar — you'll find it useful in meeting job specifications and arranging practical delivery schedules. 180-48

GRAYBAR ELECTRIC COMPANY, INC.
Executive Offices:
Graybar Building, New York 17, N. Y.

Avoid electrical delays—plan ahead . . . via GraybaR

IN OVER 100 PRINCIPAL CITIES



PLEXIGLAS SCALE MODEL, complete to smallest detail, served as a preconstruction experimentation center for locating each machine, transformer substation, distribution center, power feeder and lighting fixture. Final efficiency of layout and electrical installation proved the value of numerous planning-stage discussions similar to this one between president A. H. Tinnerman, George Tinnerman III (left) and plant engineer J. F. Rafferty.

Electrical Design Speeds Production

Effective power distribution, control and lighting, by Parker Electric of Cleveland, are key factors in Tinnerman Products' round-the-clock production of industrial speed fasteners.

By Charles A. Slack
Plant Electrician
Tinnerman Products, Inc.
Cleveland, Ohio

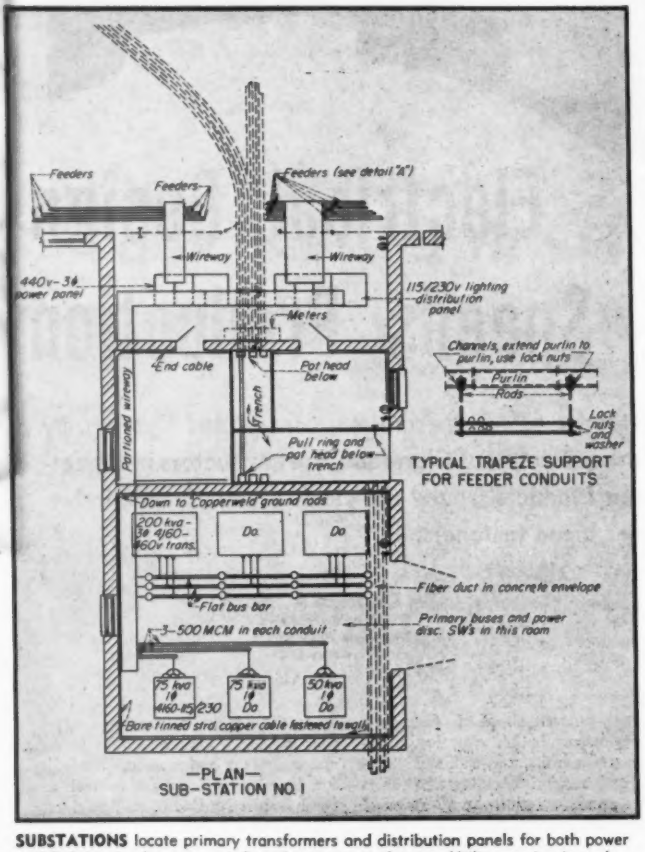
INCREASED production for national security—through planned lighting and improved vision, efficient power distribution and control, modern materials-handling methods and approved safety practices—is tangibly demonstrated at Tinnerman Product's recently-completed plant in Cleveland, Ohio. For there—where over 5000 varieties of speed nuts and clamps are being manufactured for the aviation, automotive, construction, home appliance and electronic industries—the latest developments in modern equipment design are combined with practical planning and architectural artistry.

Distribution varies with local requisites, resulting in the utilization of plug-in busduct, wireways, underground concrete-sheathed fiber-duct, floor trenches, flexible vibration-resistant machine leads, thin-wall and standard rigid conduit. Lighting also varies with areas, ranging from recessed fluorescent troffers in offices to mercury-incandescent illumination in high-bay factory sections and twin-floodlight installations for outdoor parking. Color-coding of all conduits and ducts, the use of photocell door operation, a plant-wide fire alarm annunciator system and unusual flexibility for lighting and motor control are other features of this $2-million, 4-acre industrial enterprise.

The logical straight-line positioning of manufacturing equipment and the functional routing of power are not just coincidental. For long before a ma-

INDUSTRIAL FLUORESCENT UNITS light the press area to approximate 40-footcandle intensity. Presses are powered from overhead 225-amp, 440-volt busducts through 3-pole bus plugs, rigid conduit drops, flexible machine leads and individual control stations. Each machine is plainly numbered to facilitate work scheduling and maintenance check-ups.

RESEARCH AND DESIGN areas are illuminated to 85-footcandle level by grid of 2-lamp industrial lighting units combining separately-suspended luminaires, at right angles to continuous runs.



SUBSTATIONS locate primary transformers and distribution panels for both power and lighting in the same reinforced-concrete enclosures. Utility service is underground via concrete-sheathed fiberduct, while connections between transformers and switchgear are through partitioned wireways. Feeders from switchgear are trapeze-supported.

chine was moved from Tinnerman's former plant into the new brick-and-steel shell, a detailed plexiglas model with a ¼-inch scale was constructed in which each machine, transformer, switchboard, panel, utility line and lighting fixture was fabricated in miniature and accurately positioned. All construction and installation problems were solved in advance on this model. All office and manufacturing equipment was plainly numbered and pre-spotted on the open floor. And all electrical and mechanical services were installed prior to moving day. The actual shift into the new, larger site was relatively problem-free, calling merely for the breaking of connections in the old plant, trucking equipment to the new factory, shimming-up and connecting machines in their new predetermined positions. It was a precision moving job resulting in the rapid resumption of three-shift round-the-clock production.

When completed, color-coding of conduits will tell at a glance what utility is enclosed. For example; yellow-banded lines contain 110-volt ac power, yellow and black represents 440-volt service, and yellow and green means 4160-volt ac. Yellow and white is used for 220-volt dc lines; yellow and blue indicates empty duct; yellow and purple is reserved for telephone cables; yellow and red indicates the ADT sprinkler alarm system; and vermilion-red plainly indicates fire lines. Color is also used liberally throughout the plant to distinguish moving parts from stationary machines, warn employees of hazards, outline storage areas and open aisles, and improve lighting maintenance factors.

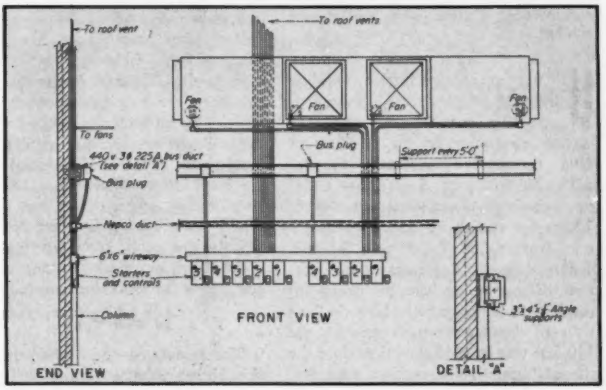
HIGH-LEVEL ILLUMINATION on critical working surfaces insures accuracy of die-cut results and safety of employees working on experimental patterns for new types of speed nuts, clips and clamps.

RECESSED TROFFERS with opal glass bottom panels, complete air conditioning, underfloor two-channel ducts for telephone and electric business-machine service, photo-cell door operation and a pneumatic tube system for interplant communication are features incorporated in Tinnerman's modern office design.

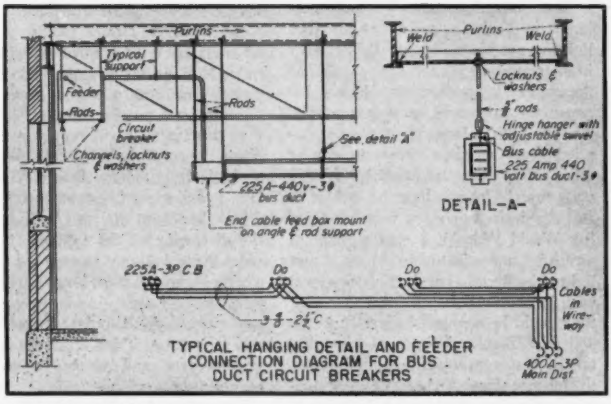
Power distribution employs two substations, staggered circuiting and cascaded switching to promote continuity of service, safety and flexibility of control. Combined, the two substations contain nine transformers; three 200-kva. and one 100-kva. 3-phase 4160/460-volt units, two 75-kva. and three 50-kva. single-phase 4160-115/230-volt assemblies. Primary service from the Cleveland Electric Illuminating Company is underground via 4-inch ducts in a concrete envelope. Connections between transformers and distribution panels are via elevated bus structures and cables carried in partitioned wireways (for secondary and low-potential current). Feeders to local power and lighting panels are run in trapeze-supported conduits. All substation equipment is grounded to bare tinned stranded copper 1/o cables and copperweld ground rods.

Through the factory sections, distribution is essentially through 225-amp, 440-volt plug-in busducts located 11 feet above floors, supported at 5-foot intervals along walls and columns by means of angle brackets, and beneath roof purlins by means of rod hangers fitted with adjustable swivel bolts. Duct runs are protected by channel-and-rod-supported circuit breakers, connected to bus runs through end cable feed boxes. Branch lines to presses, punching machines, fans, unit heaters, sump pumps and other motorized equipment are tapped to the main distribution framework through 3-pole bus plugs. Final connections to individual machines are through local control panels and flexible vibration-absorbing leads.

(*Continued on page* 126)

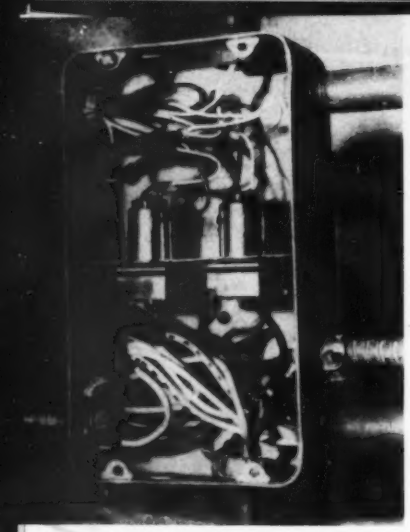


PLUG-IN BUSDUCT, wireways and rigid conduit are combined for distribution and control flexibility. Starters and controls are positioned on walls 5-feet above floor level. Feeder ducts are supported at 5-foot intervals by brackets.



CIRCUIT BREAKERS protect each 225-amp, 440-volt, 3-phase busduct. Four breakers are connected to a 400-amp, 3-pole main disconnect through 4/0 cables carried first in wireways, then in conduit.

277 Volt Relay Switching



PARTITIONED BOX houses two relays and provides circuit isolation on fire resistive construction. Control wires are run in conduit.

UP to the present, office building lighting in the United States has generally been supplied from substation equipment in the building or from secondary distribution systems with 230/115-volt, 3-wire, grounded neutral, single-phase feeder circuits or, where the utility has a network system, from a 208 Y/120-volt, 3-phase, 4-wire supply. A primary consideration, of course, has been the use of incandescent lamps, which show the best over-all economy when designed at the 110-120 volt level. Excursions into the use of higher voltages have been discouraged by lack of appropriate light sources, by considerations of safety, and by the fact that the higher voltage was not available.

The introduction of fluorescent lamps in 1939 changed many previous lighting practices, but parallel changes in distribution have not kept pace. The fluorescent lamp requires a ballast between the lamp and its power supply. The fluorescent lamp itself can be supplied from a distribution system at other than the traditional 115/120 volts merely by winding the ballast to suit the desired primary voltage. During World War II, a vast amount of aircraft manufacturing area was lighted by fluorescent fixtures equipped with ballasts rated at 265 volts, so that they could be connected directly to the 480 Y/277-volt, 3-phase, 4-wire distribution system which supplied power to the machinery. These lighting systems were frequently used 24 hours a day, seven days a week, and were controlled in large units by magnetic motor controllers from industrial-type pushbutton stations.

The modern office building with its large power load of elevators, fire pumps, air-conditioning and sanitary systems has heretofore been unable to make use of the economies of higher voltage in fluorescent lighting, because no practical means was available to control the individual office circuits at the higher voltage. Maximum rating of the conventional flush-mounted wall switches is 250 volts. The current rating of these switches must be reduced by 50% when used to control the inductive load of fluorescent ballasts. These restrictions are in the Underwriters' Laboratories Standards and in the National Electrical Code, and they are sound engineering practice. The introduction of the remote-control wiring system, with its approved use of solenoid operated relays for handling load current at 277 volts, now makes possible the use of 480 Y/277-volt lighting in office buildings because the relay system provides an economical, practical and *safe* switching means for individual office circuits.

24 Volt Control

The remote-control system used for this higher voltage application is identical with the system used in residential and commercial occupancies. The control pushbutton and the solenoid relay operate at 24 volts from a 35 volt-ampere high reactance transformer on a Class 2 signal circuit wiring system. Various kinds of control switches are available, including a master selector switch for controlling a number of circuits from one location.

One transformer will supply generally all of the controls for circuits fed from a single lighting panelboard. The relays are designed for mounting in a ½-inch knockout and can be located at the discretion of the engineer to provide the minimum amount of power wiring because it is no longer necessary to take the power circuit through the wall switch. Multi-point control is another feature which commends this system over and above its use on higher voltages.

Recently a five-story 180,000 square foot office building was estimated with both conventional 208 Y/120-volt circuits and with 480 Y/277-volt circuits. The higher voltage system showed a saving of $30 per kva of installed equipment and wiring and a saving of four pounds of copper per kva. This building is supplied by primary power at 13.8 kv which is distributed at 480 Y/277 volt, 3-phase, 4-wire from a double-end unit substation having a capacity of 750 kva at each end. Lighting equipment is provided for 55 foot candles, requiring four-volt amperes per square foot. Approximately 700 hp. of motor load is required for air conditioning, elevators and fire pumps. For 120-volt convenience outlets, approximately 1 volt-ampere per square foot is provided by 15 kva 480-120 volt transformers. In order to provide proper short circuit protection, calculations show that silver-sand current limiting fuses are required in the branch circuit panelboards. Table No. 1 shows the installed costs of the 480 Y/277-volt system compared with the 208/120 volt system.

Where power is available from the utility at 480 Y/277 volts, the cost of the installation will be less because the substation becomes only switching and protective apparatus. Where power is available only at 208 Y/120 volts as in many metropolitan areas, the use of autotransformers at about $5 to $8 per kva to raise the potential to 480 Y/277 volts makes possible a very large part of the indicated savings. These calculations are based on one building having

TABLE I

EQUIPMENT	SYSTEM	
	480 Y/277	208 Y/120
Remote control	$ 6,750	$ 6,750
Lighting branch circuit wiring	29,800	42,450
120 volt circuits and transformers	31,650	28,125
Panelboards	4,515	4,950
Unit substation	36,000	55,300
Busway risers	6,200	12,400
Air-conditioning equipment	17,450	23,370
Elevator and fire pump equipment	6,470	9,010
Totals	$138,835	$182,355
Totals per kva	$ 92.55	$ 121.57

Relay switching provides a key to use of 480/277 volt lighting in commercial and office buildings.

By H. H. Watson
Construction Materials Division
General Electric Co.

a particular load condition. Other buildings will show similar economies.

Because of the safety factors involved, the industry has heretofore been unenthusiastic over the use of voltages higher than 120 where the general public operated switches. Two new conditions should be assuring to the safe use of 480 Y/277 volts. First, the remote-control system isolates the control switches and hence the building's occupants do not normally encounter any other circuits than the 24-volt remote control circuit and the 120-volt convenience outlet circuit. In the second place, fluorescent lampholders as listed by the Underwriters' Laboratories, Inc., and generally as required by electrical inspectors, are dead front when the lamps are removed as contrasted with the exposed screw shell and center contact of an empty screw shell lamp socket. These two safety measures, not previously enjoyed in lighting, provide adequate safety for the use of 480 Y/277-volt systems.

Advantages

Not only does the remote-control system act as the key which permits substantial economies in office building wiring, but it also provides features and advantages not previously attainable. It must be remembered, too, that hospitals, factories, schools, hotels or dormitory establishments and laboratories all include office space to some degree, and to these occupancies the same advantages apply. Among the added advantages are:

A. In conventional switching it is necessary to take the total controlled load through each switch which controls that load. In the remote-control system, the load current is taken by the most direct route from the distribution panelboard to the lighting outlets. There is no looping of the power circuit through the switch locations. Only the low-voltage control circuit goes to the switch locations. Herein lies a saving in copper and conduit which increases as the size of the load increases, as the number of switch locations increases, and as the size of the office area increases.

B. There are many real advantages to be had from control of a single lighting fixture or group of fixtures from more than one location. This advantage is frequently denied to the occupant because it is impractical or too costly or even impossible to add additional conventional switches in new locations. With remote control, any number of switches without limit can be added with ease and with the finished appearance of an original installation.

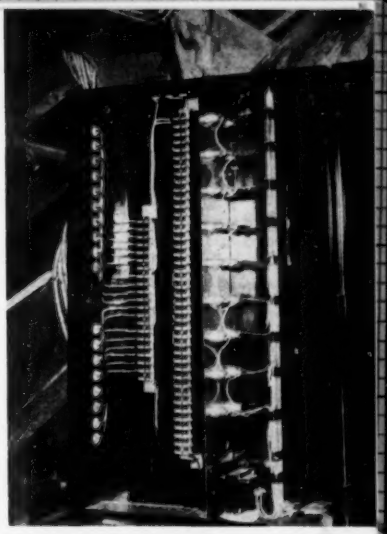
C. Often an originally well-arranged office is rearranged for changes in the requirements of the occupants. What was first good lighting control becomes cumbersome, irritating and inefficient. The remote-control system provides a straight-forward solution to this wiring problem, for with this system it is as easy to rearrange lighting controls as it is to have a telephone installed or relocated.

D. The loss of rental time while waiting for the electrical work of rearrangement to be finished is a large factor in percent occupancy.

E. The standard flush switch for lighting control is required to be mounted in a steel enclosure under rather strict Code rules. The low-voltage remote-control switch is free from most of these restrictions. The remote-control switch, for example, can be mounted directly in the metal frame of a doorway where it is most accessible to anyone entering or leaving the room.

F. One important feature of the remote-control system is that a number of relays at widely different locations can be operated from a single master switch. This switch will not interfere with the normal operation of the relays from their normal points of control. For example, with remote control, watchman circuits can be set up by which the watchman entering a building area can turn ON only a minimum of the total lights as he makes his rounds, turning the selected group of lights OFF as he leaves the area by an exit different from the entrance. This arrangement makes it unnecessary to completely illuminate large areas for patrol purposes and affords the means by which the watchman does not have to retrace his steps.

G. The availability of a relay type of control simplifies the use of time switches in connection with lighting control. Available time switches are either deficient in current-carrying capacity or are too costly to be used as freely as they are desired. The remote-control system eliminates these two disadvantages.



CENTRALIZED CONTROL in cabinet separates high and low voltage wiring, provides convenient access for circuit changes.

H. A satisfactory way to control the office fan is rarely found. If the fan is up on the wall, the switch is out of reach; if the fan is accessible, it still may be left running unnecessarily because the switch is not convenient to reach. A relay controlled convenience outlet with properly located switches, one on the desk, solves this problem.

I. A problem for which previously there has been no good solution is the matter of extinguishing lights in store rooms, closets, vaults, and similar areas. The addition of a master selector switch in a central location will enable an appointed individual to positively turn out all these lights without having to go into these rooms.

J. Many layouts show wire and conduit savings when stairwell lighting is controlled from a single location with remote control. Here the individual lights are on branch circuits from the floor at which they are located, yet from a single control point all lights can be controlled from a master switch or from a single control switch. This is important, for in some areas the need for expensive locking-type switches is eliminated. This same arrangement is applicable to hallway lights which can be controlled from the superintendent's office or from some single accessible point without the need for long runs of conduit carrying the full lighting load.

RECOMMENDED PRACTICE FOR X-RAY EQUIPMENT

CLASSIFICATION	Output MA	Output KV	Nominal Line Voltage	Trans. KVA Recommended	Size Wire Trans. to Service Switch	Service Switch to Control Switch Maximum Length	Service Switch to Control Switch Wire Size	Ground Wire	Service Fuses Amperes	Service Circuit Breaker Amperes	Service Switch Amperes
Self-Rectified											
Radiographic and Fluoroscopic—10 MA....	10	85	115	1.5	8	10 ft.	14	14	15	15	Recep.
	...	...	230	1.5	12	20 ft.	14	14	10	10	Recep.
Radiographic and Fluoroscopic—30 MA....	30	85	115	5	6	15 ft.	10	14	30 (Time lag)	25	30
	...	...	230	5	8	15 ft.	14	14	15 (Time lag)	15	30
Dental—10 MA.....	10	...	115	1.5	10	10 ft.	14	14	20	20	Recep.
Portable and Mobile—15 MA.....	15	75	115	Any line	6	10 ft.	14	14	30	25	H. D. Rec.
	...	...	230	with 3% regulation	10	20 ft.	14	14	15	15	H. D. Rec.
Mobile—30 MA.....	30	80	115		6	15 ft.	10	14	30 (Time lag)	25	30
	...	...	230	"	8	10 ft.	14	14	15 (Time lag)	15	30
Fluoroscopic and Radiographic—50-60 MA	50-60	85	230	10	6	10 ft.	8	10	50	50	60
Fluoroscopic and Radiographic—100 MA...	100	85	230	15	2	25 ft.	6	10	60	50	60
Half Wave (1 Valve)											
Fluoroscopic and Radiographic—100 KV....	100	100	230	15	2	10 ft.	4	8	80	70	100
Half Wave (2 Valve)											
Light Therapy—100 KV.....	10	100	115	3	6	10 ft.	14	14	20	20	30
	...	...	230	3	10	20 ft.	14	14	10	10	30
Light Therapy—140 KV.....	10	140	115	3	8	50 ft.	10	14	25	25	30
	...	...	230	3	10	50 ft.	12	14	15	15	30
Light Therapy—150 KV.....	30	150	230	7.5	4	25 ft.	6	10	40	40	60
Full Wave (4 Valve)											
Fluoroscopic and Radiographic—200 MA...	200	100	230	15	2	25 ft.	6	10	60	50	60
Fluoroscopic and Radiographic—500 MA...	500	100	230	25	00	25 ft.	4	8	100	100	100
Three Phase											
Fluoroscopic and Radiographic—500 MA...	500	100	230	3-10	3	10 ft.	4	8	100	100	100
Fluoroscopic and Radiographic—1000 MA..	1000	100	230	3-15	00	10 ft.	3	6	200	200	200
Deep Therapy											
Villard—15 MA.....	15	200	230	5	8	10 ft.	8	14	30	25	30
Villard—30 MA.....	20	220	230	7.5	8	10 ft.	8	10	40	40	60
Constant Potential.....	15	220	230	10	8	10 ft.	8	14	30	25	30
Self-Contained—8-10 MA..	10	200	230	10	6	25 ft.	8	10	60	50	60
Self-Contained—15 MA....	12	220	230	15	4	15 ft.	8	10	60	50	60
Self-Contained—15 MA....	15	250	230	15	4	15 ft.	8	10	60	50	60
400 KV Self-Contained.....	5	400	230	10	6	25 ft.	8	10	60	50	60
400 KV Villard.....	5	400	230	7.5	8	10 ft.	8	14	30	25	30

NOTES: In the table milliamperes is abbreviated MA: kilovolts is abbreviated KV.

The above specifications are the minimum requirements for a single X-ray machine of the rating specified.

The maximum recommended daily line voltage variation, due to causes other than the X-ray apparatus load, should not exceed plus or minus 2½% from the nominal circuit voltage.

The wire sizes under column "Size of Wire Transformer to Service Switch" are based on a run of 100 feet. If the run is over 100 feet, the manufacturer should be consulted.

If more than one X-ray machine is to be used, or additional load is contemplated for the future, larger wire and transformer size must be specified for satisfactory operation.

In general, any power supply having not more than 3% voltage drop, measured at the X-ray control terminals, due to X-ray equipment maximum load is acceptable.

MINIMUM POWER SUPPLY REQUIREMENTS with explanation notes.

	Output MA	Output KV	Normal Line Voltage*	Trans. KVA	Size Wire to Service Switch	Service Switch to Control Max. Length	Service Switch to Control Wire Size	Ground Wire	Service Fuses Amperes	Service Circuit Breaker Amperes	Service Switch Amperes
Full wave 4 valve.....	300	120–130	240	25	#0	25	4	#8	70	70	70
Full wave 4 valve.....	500	120	240	30	#00	25	4	#8	100	100	100
Deep Therapy Halfwave.....	30	250	240	25	#2	25	6	#8	50	50	50

* 240 volts not 230 volts is the preferred nominal voltage listed in "EEI—NEMA preferred Voltage Ratings for AC System and Equipment." The table, Figure 1, will be so modified in the next printing.

PROPOSED ADDITIONS to the Table of Minimum Power Supply Requirements.

POWER FOR X-RAY

Appraising the special requirements for power supply to industrial and medical x-ray apparatus.

By Walter S. Lusby
Electronics & X-ray Division
Westinghouse Electric Corp.

SOME types of x-ray loads are continuous or sustained for minutes at a time. These include: most industrial radiographic or picture taking applications; fluoroscopy or the visual inspection of shadows on a fluorescent screen in either medicine or industry; medical treatment; spectroscopy; and gauging. The solution of the power supply problem is less difficult for this type of load.

Other types of x-ray loads, mostly medical radiographic or picture taking, require much higher power for very short times.

The most powerful type of medical radiographic x-ray generator in common use today is rated at 500 milliamperes and draws 175 to 200 amperes at 230 volts. Most pictures are made at less than full power, and since one to three cycles or 1/60 to 1/20 second would be a typical exposure time at full power, rare indeed is the 500-milliampere x-ray machine which draws top current for more than one second average total time per day. An example of a very busy x-ray machine might be a transportable unit for mass chest surveys for tuberculosis case finding. Such a unit, taking 400 patients per day (a very high average), requires about 70 amperes at 230 volts for an average of perhaps 3/20 second per patient—or a total time per day of 60 seconds.

These high-power radiographic machines of the 500-, 300-, or 200-ma rating usually employ high tension bridge rectifiers, with resulting power factors of 90% or higher. Most of the lower-powered radiographic machines do not have high-voltage rectifiers, and take power from the line only when the line is of one polarity. This results in power factors of the order of 50%.

Unfortunately, the nature of an x-ray tube is such that if the fluctuations of an "average line" are allowed to reach it, the fluctuations in output of the x-ray tube in both tube current and x-ray penetrating power are very much greater. Resulting x-ray pictures are less than satisfactory.

Voltage Effects

An x-ray tube works at voltage saturation, and its current is directly proportional to electron emission from the tungsten filament. In a typical operation, a 15% drop in filament voltage will reduce the tube anode current to zero; a 5% drop in voltage will reduce the tube current to 50%. This 50% drop in tube current alone would produce a 50% decrease in photographic effect, but there is an additional loss. The penetrating power of the x-ray beam also decreases with decrease in voltage. The photographic blackening is a complex function of the voltage across the x-ray tube and several other factors, including the material being radiographed. Typically, it varies by more than the third power of the voltage, so that a 15% decrease in voltage will produce a 50% loss in film blackening. Thus, an unexpected drop in voltage of 5% would yield only about 40% of the expected blackening.

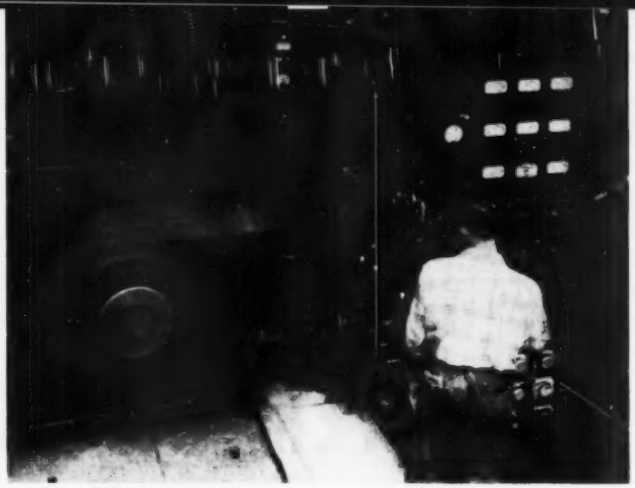
X-ray manufacturers have attempted to compensate for line voltage variations. Devices are included in most high-power and in many low-power machines to control adequately the x-ray tube anode current. Since 1938, Westinghouse has used a feedback circuit and magnetic amplifier to obtain this x-ray tube current stabilization. Steady-state x-ray tube current is held within 1%, or better, over a plus-or-minus 10% of line voltage variation. In certain applications such as x-ray gauging, the tube current variation is held to less than one tenth of 1%. No such solution is available for the high-voltage x-ray plate circuit.

The common inductor-capacitor stabilizer is not suitable for high-power radiographic x-ray use, because it requires two or three cycles to stabilize. Also it stabilizes rms voltages by disturbing the peak voltage values on which the x-ray generator depends. No stabilizer for the high voltage on the x-ray tube is in common use in the American market.

Automatic Timers

Film blackening may vary from other causes, such as imperfect selection of exposure factors by the technician. Efforts to compensate for this variable can ease the power supply problem. Over recent years, automatic timers have been developed. They monitor the radiation which is making the

INDUSTRIAL RADIOGRAPHIC machines require only low power over relatively long exposure times and, therefore, are free of the sudden short-time high demand problem of medical radiography.



X-RAY GAUGE EQUIPMENT, such as that used with high-speed tandem mills in steel rolling, requires relatively low power over a long time. Since some equipment uses a full division on the meter for a 0.0001-inch variation in steel thickness, accurate electronic stabilization of current is required.

x-ray picture, and terminate the x-ray exposure when it has been sufficient to cause the optimum blackening of the film. The usual device utilizes a phosphor and multiplier phototube, and is known as a phototimer. They compensate for imperfect technique settings—their primary purpose—and they reduce the effect of a poor supply line.

Fast Exposures

It might appear from this that top-quality present day radiographic apparatus can operate satisfactorily without special lines. This is true for medium power and for exposure times greater than 1/10th second. Unfortunately, time is varied in phototiming by discreet steps of one-half or one cycle; for techniques requiring 1/60th second, these discrete steps are too coarse, and phototiming is not used. 1/30th second exposures are borderline and acceptable only as the lower limit of a range of exposure times of longer average time. For highest power techniques, preset times still are used, and the gradations are obtained by varying tube voltage. This, of course, coincides with the worst supply line problem. Also, the stabilizers require a full cycle of pull in, and one or two cycle exposures show variation with sudden line voltage drop with the best stabilizers available. Protection of the x-ray tube against filament burn out from over voltage places some limit on the permissible reaction time of the stabilizer.

Permissible Line Voltage Variations

In 1947, the X-ray Section of the National Electrical Manufacturers Association developed a table of the Minimum Power Supply Requirements for inclusion in the National Electrical Code as information. This has been published under "Additional Tables and Information" in the appendix of the leatherbound copies of the "1947 National Electrical Code." The common paper bound copies of the Code do not contain this table. According to this table, "the maximum recommended daily line voltage variation, due to causes other than the x-ray apparatus load, should not exceed plus or minus 2½% of the nominal circuit voltage." This voltage variation is conservative and will provide satisfactory operation. Any slow drift in line voltage of no more than plus or minus 10% readily can be accommodated by manual line voltage regulators in most modern x-ray apparatus.

Any line in which sudden line voltage variations are held to no more than plus or minus 2½% will be satisfactory with any first quality x-ray apparatus with filament stabilization. Any line which has sudden line voltage variations of no more than plus or minus 5% will be satisfactory with x-ray apparatus of 300 ma intermittent rating or less, provided it has top quality electronic stabilization or complete phototiming.

Wiring Standards

The voltage drop to a radiographic x-ray machine occurs in several places: the drop from the machine to the wall switch controlling it; the drop from the wall switch to the supply transformer; the drop due to regulation of the supply transformer; and, the drop due to the additional current flowing in the primary feeder supplying the transformer. Occasionally, when the x-ray generator is fed from a small local power plant, the entire system voltage may fall. These voltage drops never can be eliminated, of course, but they can be reduced appreciably. The drop in the lead wires to the x-ray generator from the switch can be reduced by increasing conductor size and reducing its length. This approach works for the voltage drop from transformer to switch, if the transformers are located as close as possible to the x-ray load. The transformer regulation problem can be solved by installing a transformer with good regulation—which often means a large transformer. The supply system is usually heavy enough so that no changes are required. However, occasionally 2.3-kv feeders are run many miles from the substation, and their regulation is poor, and sometimes serve various pulsating loads. In these rare cases a synchronous motor-generator set, 60 cycles to 60 cycles, is used to stabilize the x-ray generator voltage.

Many manufacturers have for a long time issued reccommendations on wire size, supply transformer ratings, etc. Some of these become sizable volumes. The Table of Minimum Power Supply Requirements previously mentioned published with editorial revision by the National Electrical Committee of the NBFU is shown on page 41, and represents wiring recommendations which should be very useful and should have wide circulation. Additions to this table have been proposed but are not

(*Continued on page 128*)

NEW METHOD USING CIRCUIT BREAKERS

MATERIAL:		
Complete service section with main breaker, meter sockets, subpanel, and provision for meter test blocks, wire bussed	$425.00	
Balance of material (same required for both methods)	139.00	
Total Material Cost	$564.00	
LABOR:		
Total labor cost — 59 hours @ $2.84	$167.56	
Total Contractor Cost		$731.56

EXISTING METHOD USING GUTTER, SWITCHES, ETC.

MATERIAL:		
6—60A switches— @ $6.25	$ 37.50	
6—6 circuit breaker panels	88.56	
6—Commercial meter sockets	84.00	
1 Length—4x4x5' gutter with 2 ends	7.06	
90 ft. #8 TW wire	3.80	
12—1" Offset nipples	3.48	
18 Ground bushings	3.01	
1—¼ x4x8 Plywood panel back	15.00	
	$242.41	242.41
Balance of material (same required for both methods)		139.00
Total Material Cost		381.41
LABOR:		
Total labor cost—95.1 hours @ $2.84	$270.08	270.08
Total Contractor Cost		$651.49

Assembly of standard panel units for multiple service installation gives neat appearance and safety at low cost.

Services from Low Cost Components

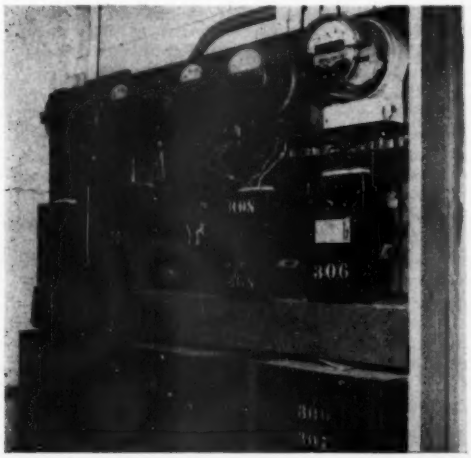
By Leonard P. Shelley
Federal Electric Products Co.

THE recent development of low cost circuit breaker panels has been adapted to custom made service equipment which heretofore was out of question pricewise. In Los Angeles, many unusual arrangements have been made using our new Stablok circuit breaker system. The equipment fabricated provides for a simpler, more attractive, safer and in many cases, a more economical electrical service installation.

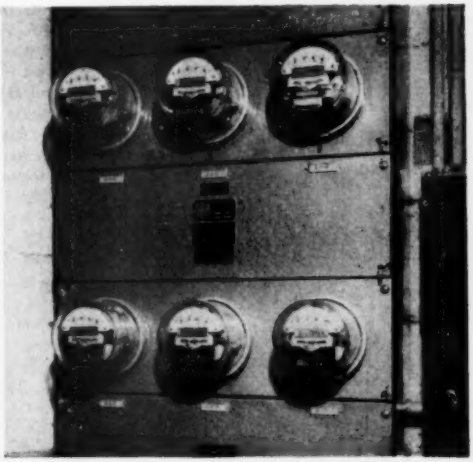
Here is a typical installation showing comparative costs of two methods of doing the same job. The work was done by the Roller Industrial Electric Company of Los Angeles, and the figures shown are from their estimate and cost sheets.

When a single tenant moved from one floor of an office building, the owner decided to subdivide that floor for six tenants. The owner asked the contractor to duplicate the third floor electrical installation on the second floor. Instead, the contractor called on us to quote on a special section using our new circuit breaker system. Subsequently, we received an order and built the required special section. The section as installed on the second floor of that building is shown.

A cost analysis of the two methods of accomplishing the required electrical installation is given in the table. The attractive and efficient custom design cost the customer only slightly more than the former method.

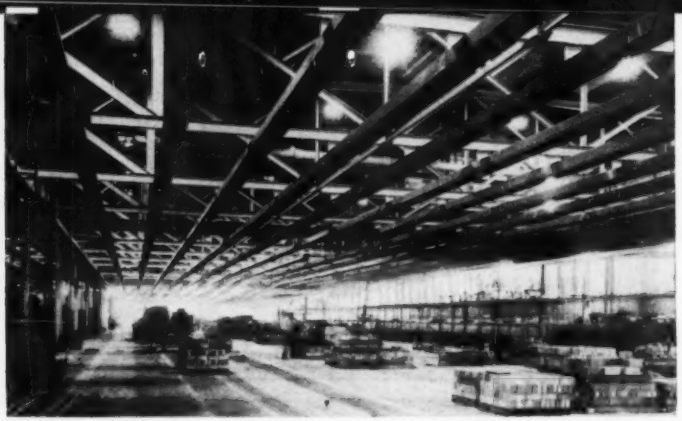


PREVIOUS METER ARRAY used many separate elements assembled on a meter board.



CUSTOM BUILT assembly uses special enclosure around standard circuit breaker panel components.

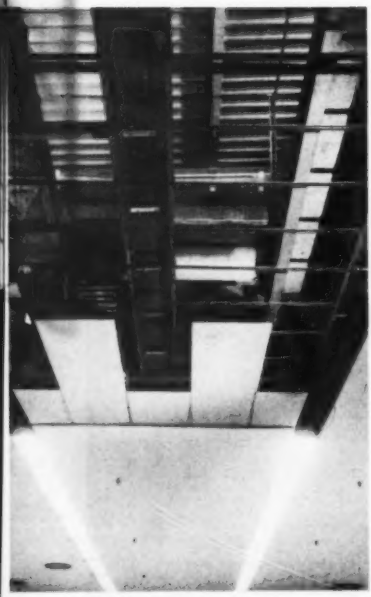
TROUGHS ARE CLAMPED to bottom chords of roof trusses.



PARALLEL TROFFER BEAMS are installed on five-foot centers; will support suspended ceiling to be installed later, also house lighting fixtures.

Integrated Ceiling Lighting

. . . A NEW SYSTEM



ALTERNATE BEAMS house continuous-row lighting system. Beam in center is covered by ceiling blocks; can be used later for additional lighting if desired. Note how beams support ceiling channels and air ducts.

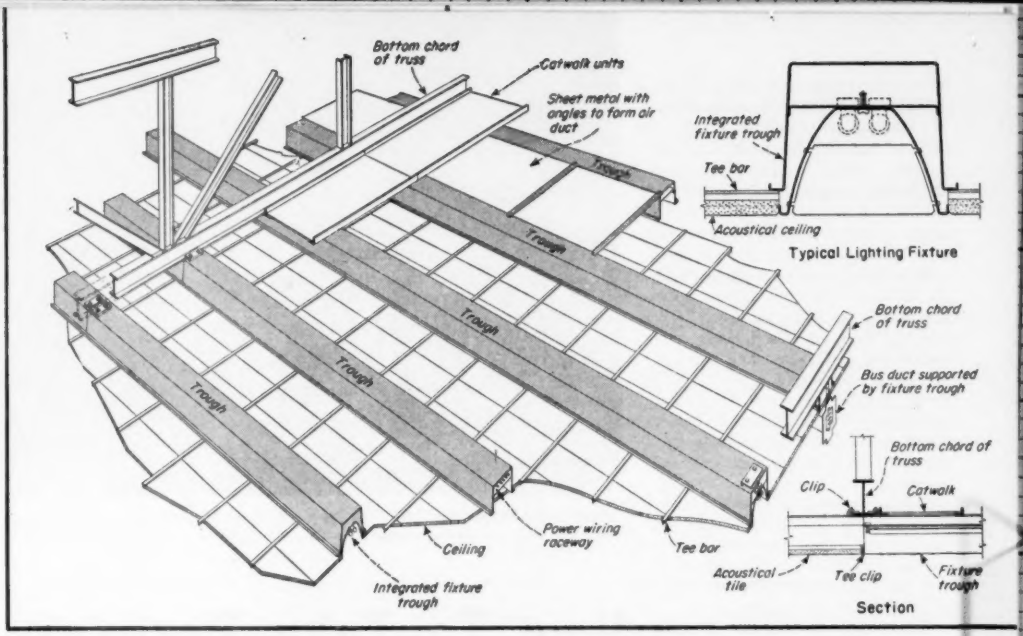
Specially designed "troffer beam" doubles as a structural member and mounting facility for fluorescent lighting fixtures; provides flexibility and installation simplicity for lighting and wiring systems.

ONE of the most recent contributions to the simplified installation of fluorescent lighting systems has been made by The Austin Company, nationally known engineers and builders of Cleveland, Ohio. Their patented Integrated Ceiling Lighting System uses a special structural member as a housing for fluorescent fixtures, a wireway, or a support for other electrical system installations. While designed particularly for industrial plants, offices and other buildings where ceilings of the preformed type are installed, the construction is adaptable for use with most any type of ceiling.

Key to the simplicity and flexibility of the new system is a specially designed trough-like structure called a "troffer beam." These beams form an integral part of the building structure; span the distance between roof trusses; are installed on three, four or five-foot centers; are fastened to bottom truss chords with special clamps to eliminate drilling; are strong enough to support the suspended ceiling, lighting system and other ceiling loads. By limiting supporting points to truss locations, the troffer beams eliminate the conventional maze of supporting rods and framework required for ceiling suspension, lighting fixtures and piping systems; leave the area between ceiling and roof free for installation of air conditioning equipment, air ducts and other facilities.

The parallel rows of troughs provide unusual flexibility for the lighting engineer. Fixtures can be installed in continuous rows or alternate spacing in each trough or alternate troughs, depending upon the desired illumination intensity. Unused troughs are covered with ceiling tiles; can be used at any time for additional lighting. Fixtures are in four-foot lengths; can be removed with a quarter-turn of two supporting bolts.

First application of this system was



INTEGRATED FIXTURE SYSTEM uses trough-like beams to double as structural member and housing for fluorescent fixtures. Troughs span trusses; support suspended ceiling, catwalks and other wiring systems.

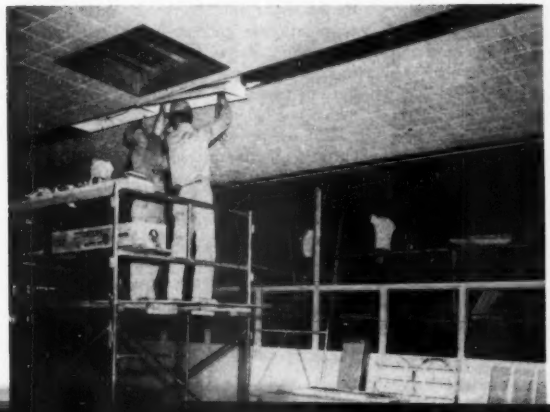
made in the new "controlled-conditions" manufacturing building of the Upjohn Company, pharmaceutical manufacturers, at Kalamazoo, Michigan. The installation of approximately 90,000 lineal feet of troffer beams on five-foot centers throughout the manufacturing area resulted, according to engineer's estimates, in a net saving of more than 40 cents per square foot. This takes into consideration the material and labor cost that would have been involved in the installation of conventional supporting means and framework for ceiling, lighting and other normal piping systems. Electrical work was installed by Rowen & Blair Electric Co., Parchment (Kalamazoo), Michigan.

Alternate troffer beams were used to house Day-Brite, four-foot, two-lamp, fluorescent fixture inserts in continuous rows. With this 10-foot spacing, a maintained intensity of 40 footcandles was obtained. Although continuous-row lighting was generally used at the Upjohn project, single fixtures were installed in a few troffer beams on different spacings where lower intensities were desired.

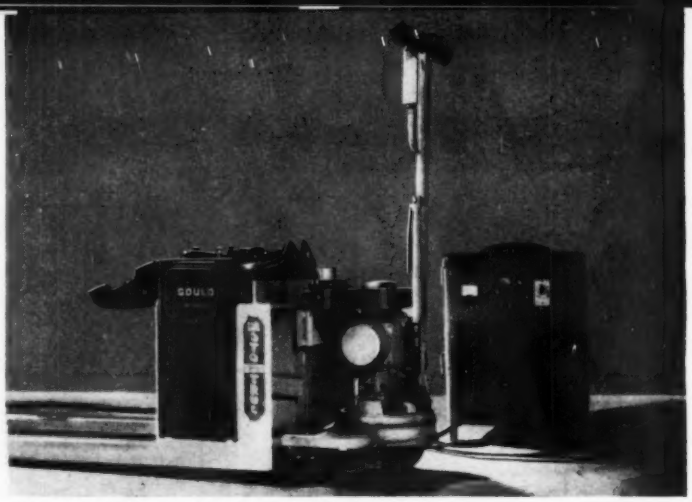
The type of fixture insert used in this installation has numerous features which facilitate change in lighting layout and minimize the maintenance chore. The fixtures are constructed of standard parts with end plates and couplings available for layout change. The glass cover frame (where used) can be hinged on either side of the fixture—a distinct advantage when fixtures are close to partitions. Hinges are of the positive type (will not be damaged by jar), yet covers can be disconnected at hinge for cleaning and maintenance. Each fixture is equipped with a fuse and can be removed by a quarter-turn on two mounting bolts. Provisions are made in the trough for locating fixture inserts on any one-foot module—an advantage when locating or relocating partitions or other building alterations are desired.

This system has given Upjohn management the degree and type of flexibility they wanted in their lighting installation. Also, by having air conditioning equipment installed in the clear space between trusses, valuable floor space was saved for manufacturing processes.

FIXTURES ARE MOUNTED to troffer beam after ceiling blocks have been installed. In some cases, fixtures are installed prior to installation of troffers.



COMPLETED INSTALLATION shows versatility of troffer beam system. Continuous row lighting in beams at right and single fixture installation in beams at left over aisle area.



"SPOT" CHARGING eliminates the transportation of equipment from outlying departments to central charging stations. As much as one hour per day per truck is saved.

How To Take Care of Industrial Truck Batteries

By K. A. Vaughan
Manager, Field Engineering
Gould Storage Battery Corp.

THE most important phase of storage battery care is charging. Undercharging can result in insufficient battery capacity to meet the duty schedule, while overcharging causes the battery to gas, overheat, and has harmful effects on the plates. The when, where, who, and how of lead-acid battery charging are presented.

In modern manufacturing processes, the industrial truck must be in operation during the entire shift, or else the integration of material flow is interrupted and work delays and stoppages result. It is therefore necessary to charge the battery when the truck is not being used. This leads to the selection of batteries having adequate capacity to supply power for full shift operation.

In general, truck batteries are put on charge at the end of the shift and charged for an eight hour period. They are then ready for the next duty cycle. For two and three shift operations, extra batteries are employed.

Occasionally, it becomes necessary to charge the battery at other times. For example, a "boost charge" is sometimes required when the truck is used to perform more work than normal. This extra work draws extra current from the battery and necessitates an "emergency" charge. The boost charge is given during a lull in the work cycle (say during lunch) and is not recommended as an everyday practice.

Where the Battery Should Be Charged

The battery can be brought to a central charging station for charging, or it can be charged by a small charger in the particular department in which it operates. In large plants where the central station may be situated some distance from outlying departments, considerable time can be saved in transporting batteries to and from the station by the installation of small "on the spot" charge stations located in the various departments.

For maximum battery life and efficiency, it is advisable that a man trained in battery technology be in complete control of battery charging.

Two Ways to Charge the Battery

In general, there are two methods of charging batteries—the "Modified Constant Voltage" method and the "Two-Rate" method.

When charging current is supplied by the MCV method, the charging current automatically tapers off as the battery becomes charged due to the increase in the counter voltage. Automatic equipment shuts off the charging equipment when the charge is complete.

The Two-Rate method of charge, as the name implies, charges the battery at two rates. Current is supplied at a high rate during the first part and greater length of the charge and at a low rate for the duration of the charge. The change from the high rate to the low or finish rate occurs at the gassing point of the battery, which is approximately when the battery is 80% charged or individual cell voltage reaches 2.37 volts at 77°F.

Either a motor-generator or rectifier is used for charging purposes. With the motor-generator, MCV or Two-Rate charging can be employed, although the MCV method is most common. Present-day rectifiers charge by the Two-Rate method.

The manufacturers of charging equipment will provide the correct charging equipment if given the number, size, and types of batteries to be charged. Charging equipment can be purchased which is capable of charging large or small, many or few, batteries.

The two methods most frequently employed to control the charge to the battery involve: (1) the ampere-hour meter, and (2) the voltage relay timer as described below.

When the ampere-hour meter is used, it is necessary to set the ampere-hour meter on the panel of the charger before starting the charge. This is necessary to be sure the battery receives the correct ampere-hour charge, depending on the extent to which it has been discharged. In setting the ampere-hour meter, the specific gravity of a pilot cell of the battery is taken and an ampere-hour meter chart, supplied by the battery manufacturer, is consulted to obtain the correct meter setting. Once the meter is set and the battery is connected, no further adjustments need be made. When the ampere-hour meter is used in Two-Rate charging, additional resistance is automatically cut-in to the circuit when the battery reaches 80% charge. This lowers the charge rate from the high rate to the recommended finish rate. When the battery is fully charged, a quick-break contact terminates the charge.

Ampere-hour meters are available

Care of industrial truck batteries is often an important function of the electrical maintenance department. Here are rules and methods for proper handling.

CENTRAL CHARGING gives one man complete control over charging operations. Notice spreader used in hoisting the battery. Spreader prevents bending.

BATTERY RECORD

Day Operator _____ Night Operator _____ Date _____

Battery Number	Charging										Put in Service			Returned			Remarks:
	Started					Finished											
	Date	Time	Amps	Temp	S.G.	Date	Time	Amps	Temp	S.G.	Date	Time	Truck No.	Date	Time	S.G.	

TYPICAL BATTERY RECORD CARD. Card indicates approaching old age or misuse of the battery; also helps in setting up charging schedules.

which can be mounted on the truck body and can be connected to the circuit so that they register both the discharge and recharge and do not have to be set for each recharge. These meters have the disadvantage of being subjected to damage during truck operations, and this damage in many cases causes inaccuracies.

When the voltage relay timer is used, it is only necessary to connect the battery to the charging equipment and the charge rates are then automatically controlled. When used with MCV method of charge, the voltage relay operates at 2.37 volts per cell at 77°F. which starts a timing device. This device terminates the charge after a predetermined time (usually 2½ to 3½ hours). With the Two-Rate method of charge, the voltage relay not only starts the timer but also reduces the charge rate from the high to the finish rate.

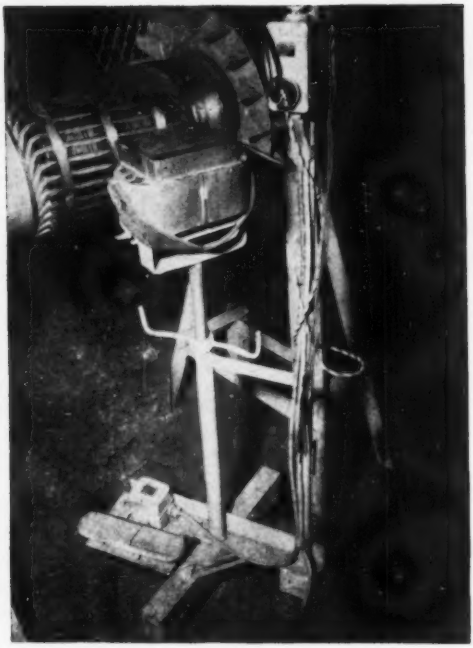
Charging equipment is set at the correct voltage for the size battery used in the plant and is seldom changed. However, voltage and charge rates should be checked periodically and for this reason charging equipment, volt meters and ammeters should be checked at least once a year. The charging equipment voltage setting will depend upon the number of cells in the battery. A value of 2.63 volts per cell has been determined by the characteristics of the lead-acid battery and by agreement within the battery industry, as that most satisfactory for charging industrial truck batteries when using the MCV method of charge. Thus, an 18 cell battery would require a setting of 2.63 times 18 or 47.34 volts.

The resistor governing the flow of current to the battery being charged also remains fixed and requires no adjusting. The current required depends on the capacity of the battery as expressed in ampere-hours. The starting rate of charging a discharged battery can be from 15 to 22.5 amperes per 100 ampere-hours capacity. Thus, a 500 ampere-hour battery would require 75 to 112.5 amperes starting rate. The finish or low rate of a battery should be 5 amperes or lower per 100 ampere-hours capacity; thus a 500 ampere-hour battery would finish at 25 amperes or lower.

The MCV method of charging is generally used because it is simpler and is slightly cheaper than the Two-Rate method. It is recommended for use where the voltage relay timer is used to control the charge because occasionally the voltage relay timer does not work. If Two-Rate charging was used in conjunction with this voltage relay timer, the battery would be charged continuously at a high rate resulting in overheating, gassing, loss of electrolyte, and if repeated often, serious damage to the plates. The Two-Rate method is always used when the bus voltage is greater than 2.63 volts per cell.

In all charging operations it is recommended that records be kept on each battery. This data not only gives a case history of the battery but age and damage warning.

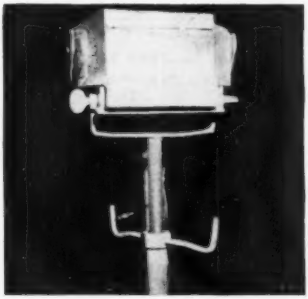
TESTING AN ARMATURE with a standard growler mounted on a portable stand. Note foot-switch control and angle reflector for localized illumination.



PORTABLE GROWLER STAND has threaded rod adjustment for height; permits growler unit rotation in horizontal plane; has long extension cord for connection to any shop outlet.

Adjustable TEST GROWLER

Portable stand with vertical and horizontal adjustment makes standard growler a flexible test unit.



CLOSE UP of vertical adjustment device and thumb-screw mounting of growler in supporting saddle.

Regardless of where armatures may be in the motor repair department of the Koontz-Wagner Electric Company in South Bend, Indiana, they can be quickly checked with a standard test growler. The unit is merely moved to the armature and adjusted to the required height.

Such portability and operating flexibility is provided by a special stand designed and built by shop superintendent E. R. Pearson. The pedestal consists of a length of pipe mounted to an angle-iron X-frame with casters. Telescoping inside the pipe upright is a 1-in. diameter threaded rod which supports a flat-iron cradle in which the standard growler rests. Two thumbscrews hold the growler securely in position.

The growler can swivel 360 degrees; can be adjusted in height from 27 inches to 42 inches (center of growler to floor) by turning a stop-nut on the pipe pedestal. A second five-foot pipe upright supports an outlet box with a plug outlet for the growler and a toggle switch to control a 75-watt angle reflector at the top. The reflector has a thumb-screw mounting so it can be adjusted in a vertical plane.

The portable stand can be plugged into any convenient outlet in the shop. A foot-switch at the base of the stand turns the growler on and off; leaves the mechanic's hands free to rotate the armature and manipulate the metal "feelers."

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FOR MAXIMUM SPEED of installation... topmost maintenance economy... operational ease, safety and efficiency... the Federal Noark Bus Duct system is today's best buy.

To begin with, the unique Noark adjustable sliding drop hanger permits the most convenient location of supporting rods and provides the quickest method for installing bus duct that was ever devised. And from then on you get all the advantages brought by Federal Noark Bus Duct special features:

Interlocking Four-Channel Steel Housing . . . welded and screwed together to assure greatest strength. Even the longest runs are bound to be straight and true.

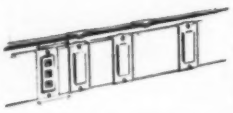
Extra Rugged Interior Construction... with the bus bars rigidly held by porcelain insulated receptacles every twelve inches. The bus bars are designed to withstand heavy fault currents.

Positive Contact . . . bus bars are silvered over their entire length. Plug-in stabs reinforced with heavy steel springs.

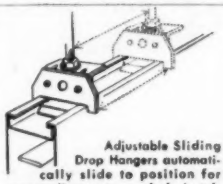
Insulated Plug-in Openings . . . no bus is exposed... operator is safe when changing plug-in device. For extra protection, new hook-on bars support plug-in device during installation.

Unsurpassed Heat Dissipation . . . staggering of insulators on alternate sides of duct provides continuous air passage and coolest operation.

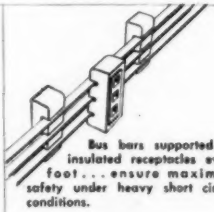
Federal Noark Bus Duct is factory-assembled in 10-foot sections, and completely flexible for future needs. For the full story, write Federal Electric Products Company, 50 Paris Street, Newark 5, New Jersey.



Sliding, self-locking cover plates, protecting insulated plug-in openings, safeguard electricians.



Adjustable Sliding Drop Hangers automatically slide to position for exact alignment . . . slash installation time.



Bus bars supported by insulated receptacles every foot . . . ensure maximum safety under heavy short circuit conditions.

Interlocking four-channel construction assures greatest strength . . . even long runs are straight as a plumb line.

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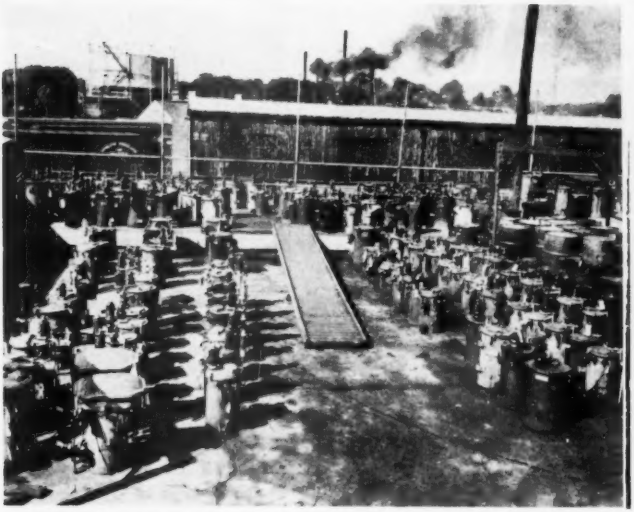
Practical Methods



MATERIALS HANDLING is performed with minimum effort and time consumption through the use of roller conveyors.

Roller Conveyor For Unloading

MATERIALS HANDLING

Unloading material or equipment from a truck to a receiving platform can be facilitated by a roller conveyor, such as the one utilized by the Electric Motor & Repair Company in Raleigh, N. C. This section is raised and hooked to the tailgate of their 12-ton trailer-truck, and transformers are quickly positioned on the upper end, sliding to the platform by gravity. Roller conveyors are also used by EM&R to carry transformers into the shop, from one repair area to the next, and finally into the storage area where they are tagged for redelivery. With the use of these conveyors, materials handling is fast and easy. Since the shifting of equipment frequently accounts for more than half the cost of production, repair or sales, any method resulting in easier materials handling is a step towards reduced overhead.

Infrared Oven Cures Synthetic Enamel

PRODUCTION

Two minutes of intense, zoned infrared heat in a space-saving aerial electric radiant oven provides rapid curing action and a hard, true color to synthetic enamel sprayed on engines manufactured by the McCulloch Motors Corporation, Los Angeles.

The all-metal infrared oven, which is conveyorized by a continuous chain trolley system, delivers consistent results on a production basis with low maintenance cost and trouble-free operation. Three zones of heat are provided in the oven for maximum drying speed at proper temperatures. Each zone is the length of a 4-foot heating unit, and varying degrees of heat are obtained by controlling the elements with contactors. Generally, the first section is operated at full intensity to bring the material rapidly to the best drying temperature. The second and third units are operated usually at 50% and 25% of full capacity, although these levels are increased as humidity rises, sometimes requiring the latter two units to operate 90%. This control is regulated by rotating a hand knob.

ELECTRIC CURING OVEN, consisting of all-metal radiant heating elements and located 12 feet above the floor of the McCulloch Motor Corporation's Los Angeles plant, is compact, out of the way, non-breakable, easily regulated and maintenance free.

Each 4-foot zone consists of seven 1800-watts 230-volt units, bolted to curved steel bands. Spacer sheets of Alzak aluminum (the same material as the heater reflectors) were fitted into grooves on each side of the heaters to increase the efficiency of the ovens. Clearance inside the oven is 26 inches, sufficient to handle two sizes of engines which are rotated as they pass through the ovens at a constant speed of approximately 5½ feet per minute. Together, the three heat zones measured 12 feet in length and have a total electrical load of 37.8-kw.

Since the intense heat emitted by the all-steel tubular Inconel sheathed elements is in the far infrared zone of the spectrum, it is absorbed with almost equal speed by all colors and heat need not be greatly varied for different colors used on the various products. Floor space is not used since the oven is 12 feet above the manufacturing area. And the all-metal construction of the heating elements has eliminated breakage and maintenance problems.

Power Paging Overcomes High Noise Level

COMMUNICATIONS

To overcome unusually high noise levels in their extensive 13½-acre Thompson Road plant in Syracuse, New York, the Carrier Corporation has installed an RCA voice paging system designed to overcome noise levels as high as 112 decibels, equivalent to the sound of thunder or heavy street traffic. The system was installed by the Morris Distributing Company of Syracuse.

The installation consists of rack-mounted amplifying and relay equip-

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COMPOSITE PICTURE shows wide-angle paging trumpet installed in Carrier Corporation's 13½-acre plant, and microphone of sound system designed to overcome noise level of thunder in the turbine manufacturing areas. Priority-type relay circuits permit system to be operated in case of emergency by operators located in another Carrier plant 8 miles away.

ment and an array of more than 200 loudspeakers, including both paging trumpets in large open areas and cone-type speakers with two-way baffles for use in corridors. It is completely flexible and functional, and designed to provide efficient communication between two of the Carrier plants, eight miles apart. A priority-type relay circuit allows four telephone operators at the central plant to take over completely in the case of an emergency and enables them to use it in completing long distance telephone messages.

The sound system features automatic volume control pre-amplifiers, high-fidelity power amplifiers individually controlled by plate relays and capable of providing 70 watts output at extremely low distortion ratings, and wide-angle paging trumpets. A total of 12 power amplifiers is required to adequately cover all areas of the large manufacturing plant. They are so zoned that failure of any individual amplifier will not affect the overall operation of the system.

Electric Stud Welding Aids UN Construction

CONSTRUCTION

Drilling and tapping approximately 50,000 holes for anchoring purposes in the new United Nation's Secretariat Building in New York City looked like a tremendous job, but the use of Nel-

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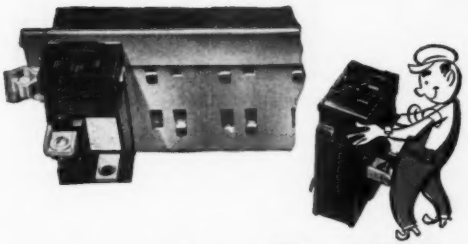
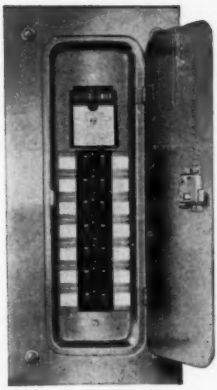


2. individual units for flexible installations

Service Equipment Type
Up to 8 circuits



P1B Type
4 to 20 circuits
Single Phase, 3 Wire

P3B Type
12 to 42 circuits
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These handsome Pushmatic Electri-Centers are representative of BullDog's complete line for finest circuit protection and control. Write now for complete information.

SIMPLEST switching . . . most flexibility . . . surest protection . . . easiest installation . . . they're all yours in BullDog's Pushmatic Electri-Centers.

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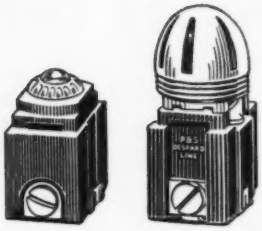


CAT. NO. 1375 CAT. NO. 1340

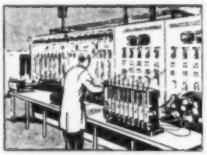
P & S-DESPARD PILOT LIGHTS FOR MODERN INSTALLATIONS

By using the P&S-Despard Line, a convenient pilot light can be included with one or two switches, or outlets, under a one gang plate. Cat. No. 1340 has S-6, 6 Watt lamp. Cat. No. 1375 has 1/25th Watt Neon lamp (very economical). Also available, a flush pilot with plastic jewel for use with single switch or outlet in one gang installation.

● P&S Wiring Devices are designed and manufactured to unusually high standards for dependability, performance and ease of wiring. They meet or exceed the minimum safety standards of existing testing agencies.

PRECISION MANUFACTURING

SKILLFUL ASSEMBLY



THOROUGH TESTING

Sold Through Electrical Distributors
For Complete Information Write Dept. M

PASS & SEYMOUR, INC. • SYRACUSE 9, N. Y.

HALF-INCH STUDS welded to I-beam inserts in the concrete floor slabs provide firm anchors in the new UN Secretariat Building. Light in weight and easily handled, the Nelson stud welding gun made this procedure a comparatively simple operation.

son stud welding guns made the job seem easy. One-half-inch cadmium-plated studs, flux filled, were positioned with the aid of a template and were welded into position quickly and accurately.

The method, recommended initially by the General Bronze Corporation, fabricators and installers of the 5400 floor-to-ceiling windows, was instantly appreciated by architects Harrison and Abramovitz as well as by builders Fuller, Turner, Walsh and Slattery. They applied the method to other applications, such as fastening ornamental metal and lighting fixtures, with the result that time schedules could be stepped up impressively.

Disconnecting Hangers Cut Lighting Maintenance

MAINTENANCE

Outdoor disconnecting and lowering lighting fixture hangers, installed by The Perfection Stove Company for all parking lot, driveway and building walkway luminaires at their Ivanhoe Road, Cleveland, plant, are effecting definite maintenance savings and insuring personnel safety.

The hangers, made by the Thompson Electric Company, provide for rapid and safe lowering of the units to ground level, eliminating the necessity of climbing 25 feet to the luminaire elevation. Since the presence of high fences and vehicular traffic formerly constituted a hazard when maintenance men were compelled to climb up to service the lamps, and since the lowered fixture is now completely disconnected from the feeding circuit, the element of safety has been greatly improved.

For More Than Sixty Years

CRESCENT WIRES & CABLES

Have Played A Leading Role In
The Growth Of The Electrical Industry

OVER
60
YEARS
EXPERIENCE

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, NEW JERSEY

JEFFERSON FUSES Act Positively on Dangerous Overloads . . . . .

• Save costly and needless blowing of fuses by specifying Jefferson SAF-T-LAGS. This is a Fuse so accurately calibrated and job-rated that *harmless* overloads of short duration cause no reaction while POSITIVE PROTECTION is immediately provided should excessive and damaging overloads occur.

You minimize production delays and work stoppages with Saf-T-Lags because they will not shut down a circuit unless absolutely necessary. Yet you always have full protection on heavy overloads and short circuits. Saf-T-Lags also provide THERMAL protection to panel boards and switching equipment thus avoiding damage caused by poor contact, insufficient air or poor heat dissipation. Furthermore, with Saf-T-Lags you are safeguarded against motor burn-outs due to single phasing of polyphase motors.

Approved by Underwriters' Laboratories, Inc.

For the complete story on Saf-T-Lags send for Folder 482-ST.

JEFFERSON THERMAL SAF-T-LAG FUSES

JEFFERSON ELECTRIC COMPANY • Bellwood, Illinois

COMPOSITE PICTURE shows maintenance man at Perfection Stove Company, Cleveland, relamping outdoor lighting unit (center), fixture in locked position (upper left) and in the process of being lowered for ground-level servicing (lower right).

Standard 2-pole outdoor hangers incorporating deep canopies to protect fixtures and connections from the weather are used by the Perfection Company, with individual light poles equipped with from three to six hangers, each controlled independently from the ground level.

Pulley wheels for lowering chains, guide tubes and a pair of cup-type contacts are contained in the upper hanger member, while a positioning stem, latching mechanism and pair of ball-face contacts for circuit connection are included in the upper hanger member.

CONGRATULATIONS for a successful show are offered by C. C. Simpson, managing-director, Electric Association, Chicago, to John McC. Price (right) of Allen-Bradley Company and chairman of the show committee. Occasion: Recent Industrial Electrical Show sponsored by the Electric Association of Chicago and the first exposition of its type in the city since 1941. Show drew attendance of more than 8,000 engineers, contractors and electrical maintenance men on admittance by invitation only.

THEY MAY LOOK ALIKE... BUT NEVER ACT THE SAME!

Imitation, as the saying goes, is the greatest source of flattery. However, there are times when it can also be the greatest source of trouble. So, remember when buying, screw anchors...

THE INSEPARABLES

*Substitutes

CAN PROVE DANGEROUS!

The word "Rawlplug" used in connection with *Jute Fibre Screw Anchors* is exclusively the property of The Rawlplug Company, Inc. For forty years it has been secured to them by common law and by trademark registry. It is the corporate and trade name of the company and specific product of their manufacture.

BE SECURE BY BEING SURE

Look for the Trade Name **RAWLPLUGS** *on the* Blue Box

THE RAWLPLUG LINE

RAWL-DRIVES
Bolt and Anchor in one piece—[illegible] like a nail into a drilled hole and holds like a bolt. Used only in hard materials, such as concrete, brick, etc.

RAWL-DRIVES

RAWL-TAPERS
...machine screws. A Machine Screw ...chor that fits the hole drilled, ...her by a new or worn drill.

RAWL-TAPERS

RAWL HAMMER-SETS
Heavy duty threaded type machine bolt anchor. Ideal for bottomless holes, hard floor topping.

RAWL HAMMER-SETS

RAWL-ANCHORS
...for holding bolts permanently in materials such as concrete, marble, stone, brick, etc. Heavy duty type.

RAWL-ANCHORS

RAWLDRILLS
The original 3-point drill for drilling holes in all masonry. Quickly and easily sharpened. For hand and power drilling. Also Rawl Carbide-Tipped Drills for use in electric drills sizes $\frac{1}{4}$" to $1\frac{1}{2}$".

RAWLDRILLS

When you use Rawlplugs you are using the original and genuine... the only screw anchor with the features that make them worthy of imitation... RAWLPLUG!

Rawlplugs because of their chemically treated braided jute fibre construction... Hold Better ... Last Longer ... Weigh Less and Hold More! They eliminate extra troublesome spotting and layout work. Rawlplugs are the only universal anchors which can be used in any material.

"IF YOU DON'T USE RAWLPLUGS... THERE'S A SCREW LOOSE SOMEWHERE"

For Information write Dept. E

12-L-11

The Rawlplug Company, Inc.
271 Church Street, New York 13, New York

THERE ARE RAWL
... EXPANSION BOLTS, SCREW ANCHORS AND MASONRY DRILLS FOR EVERY NEED.
SOLD THROUGH ALL LEADING HARDWARE, ELECTRICAL AND MILL SUPPLY HOUSES

FOR Hard-to-Start Jobs

Requiring Low Starting Current

SPECIFY

Century

TYPE RS*

MOTORS

* *Single Phase, Repulsion Start, Induction, Brush Lifting Motors*

Century Electric Company is celebrating its 50th year in the electrical industry.

Century SERVICE

Is Near Any CENTURY Motor Driven Equipment

Satisfactory performance of CENTURY products is assured by more than 200 CENTURY Authorized Service Stations supervised by 28 CENTURY Sales Offices.

1. Facilities for immediate exchange of most CENTURY standard ratings of standard construction are available at CENTURY Authorized Service Stations.
2. CENTURY Authorized Service Stations are qualified and equipped to service and repair any piece of CENTURY apparatus.
3. Genuine CENTURY renewal parts are available at CENTURY Service Stations, CENTURY Parts Distributors and at the factory in St. Louis.

You will find that these rugged, dependable motors meet the starting, accelerating and running characteristics of such equipment as refrigeration compressors, air compressors, stokers, reciprocating pumps, and other hard-to-start loads.

For more than 47 years, Century Type RS motors have given satisfactory service throughout the world. They are available in sizes from ½ to 20 horsepower, in drip proof and splash proof frames.

In addition, Century builds electric motors in a wide range of types and kinds—in sizes from 1/6 to 400 horsepower for operation on single and polyphase and direct current. Specify Century motors for all your electric power requirements.

ALTERNATING CURRENT MOTORS

POLYPHASE

Squirrel Cage Induction—1/6 to 400 H.P.
Wound Rotor Motors—1 to 400 H.P.
Synchronous Motors—20 to 250 H.P.

SINGLE PHASE

Split Phase Induction—1/6, 1/4, 1/3 H.P.
Capacitor—1/6 to 20 H.P.
Repulsion Start, Brush Lifting, Induction—1/2 to 20 H.P.

DIRECT CURRENT MOTORS

1/6 to 300 H.P.

GENERATORS

AC, .63 to 250 KVA
DC, .75 to 200 KW

GEAR MOTORS

1/8 to 1-1/2 H.P.

MOTOR GENERATOR SETS

AC to DC, AC to AC
DC to DC, DC to AC

Open Protected, Splash Proof, Totally Enclosed Fan Cooled, Explosion Proof.

Ball Bearing motors are factory lubricated for several years' normal service. Bearing housing construction permits easy re-lubrication when unusual service demands it.

Century C MOTORS

CENTURY ELECTRIC COMPANY

1806 Pine St., St. Louis 3, Missouri

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872

Motor Shops

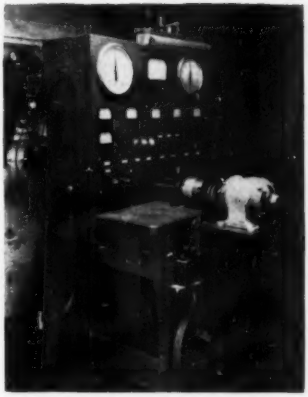
Multi-Phase Board Cuts Motor Test Time

A customer has faith in a repair organization that has facilities to properly and accurately diagnose electrical equipment troubles. This has been proved many times over at the repair division of the L. R. Klose Electric Company in Kalamazoo, Michigan. Since the design and construction of a test unit that accommodates motors of different voltage and phase characteristics, the Klose organization has eliminated considerable customer dissatisfaction and added other loyal clientele.

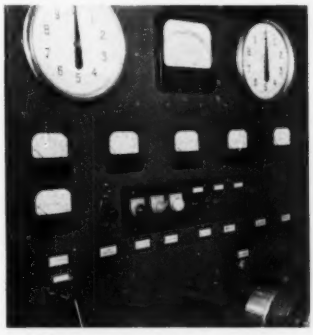
When World War II increased the demands on the service industry, vice-president John H. McGlinsey decided to equip the Klose firm with a test board that would take care of the single, two and three-phase motors coming into the shop and also eliminate the possibility of human error during tests. He purchased a Potter & Rayfield absorption-type dynamometer set, designed to develop 30 ft.-lbs. and test 220-volt, 3-phase motors; re-designed the unit so he can now test motors from 1/6 to 10 hp, 115-, 230- and 460-volt, single and three-phase.

A new power cubicle was built adjacent to the dynamometer to house two 10-kva., Scott-connected transformers with the necessary transfer switches, main line contactors and other accessories to provide the various test voltages plus single-, two- and three-phase power. This 30-inch wide by 6-ft. by 4-ft. unit is built of angle-iron with 16 gauge sheet steel top, side, and end panels, plus an ebony asbestos front panel. Two motor-generator sets are mounted on top of the cubicle. One, a 5-kw unit, furnishes from 0 to 230-volt direct current for testing dc motors and is controlled by a push-button on the cubicle panel. The other, rated 15 volts at 100-amperes, provides direct current power for the dynamometer load coils.

Also mounted on the cubicle panel are the following: an "on-off" push-button controlling the main line magnetic contactor; a flush-mounted drum switch for selecting two- or three-phase power. A back-of-board, 3-pole, double-throw knife switch with protruding operating handle has its center terminals connected to a set of test leads; its top terminals fed by the transformer bank; its bottom terminals fed from the 460-volt, 3-phase, 60-cycle utility service. A 4-pole, single-throw switch connects to a set of leads for 2-phase testing.



MULTI-VOLTAGE DYNAMOMETER is used to test single and three-phase 115, 230 or 460-volt motors up to 10 hp in size. Adjacent power cubicle with transformers and motor-generator sets serves the dynamometer and provides test facilities for larger motors plus 2-phase power.



DYNAMOMETER PANEL has array of meters and selector switches which speed up and simplify testing of motors of various voltage and phase characteristics.

Colored pilot lights on both the cubicle and dynamometer panels follow this color code:

White—115-volts
Green—230-volts
Red—460-volts
Yellow—3-phase
Blue—2-phase

The absorption unit on the dynamometer consists of two aluminum discs with six 15-volt load coils. A tachometer generator registers on a 0-2,000 rpm. indicator dial on the dynamometer panel. Two torque scales, one on each side of the panel, register up to 10 ft.-lbs. for either direction of rotation of the motor under test.

Among other instruments mounted to the dynamometer panel are the following:

A single-phase wattmeter (115/230-volt) and a polyphase wattmeter.

A triple-range voltmeter (0-150-300-600) with switch for phase-to-phase indication.

A special Ohmite 100-ampere tap switch of tandem construction which controls the ratio of the current transformer (5/10/20 amperes).

A special six-throw and "off" selector switch for the dynamometer load coils. The first coil is in series with an Allen-Bradley rheostat.

A special R.S. Type R-2 switch, ten-pole, triple-throw and "off." This is the main selector switch that controls the various contactors for voltage changes—changes on instruments from one voltage to another. All changes are indicated by pilot lights.

Maximum starting torque and locked rotor current can be secured by a simple twist of the wrist and pressing of a pushbutton.

Motors under test are set on a table that can be raised or lowered for shaft alignment. Coupling between shafts is made with a three-jaw chuck on the dynamometer shaft. Smaller motors are held securely in position by an inverted-U bracket with an adjustable screw clamp. Motors with frames too large for this bracket are fastened to the table with large C-clamps.

Although the dynamometer can take units of only 10 hp and less, larger motors can easily be tested with the facilities provided by the adjacent power cubicle. Combined, they make a flexible, compact test unit able to take care of almost any type of motor that may come into the Klose shop. And it's only a matter of a few minutes before a test can be completed and results recorded.

Yoke And Wormgear For Testing Table

When motors are tested on the dynamometer in the shop of the Tennessee Electric Motor Service Company in Knoxville, they are supported on a steel pedestal equipped with a leveling

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FOR LEADERSHIP

In the future, as in the past, you can look to Western Insulated Wire Co. to develop and manufacture Bronco portable cords and cables that are...

TOUGHER
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MORE CONVENIENT TO USE

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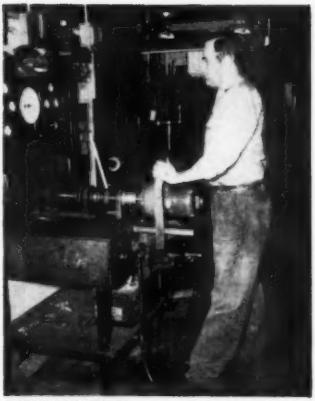
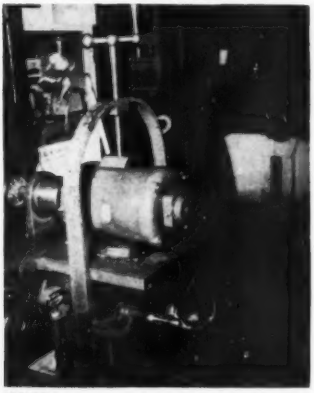
SPECIALISTS in the design and manufacture of portable electrical cords and cables.

PIONEERS in the manufacture of standardized Neoprene-jacketed cords and cables.



DYNAMOMETER is controlled by foot pedal, leaving hands of operator free for other purposes. Meter dials are large and well lighted for accurate reading.



YOKE on mounting pedestal can be raised or lowered for various clearances, while worm clamp holds motor firmly. Pedestal platform is raised to proper elevation by a wormgear hand-crank.

device and holding yoke. The leveling device consists of a worm and bevelled gear arrangement, operated by a hand-crank beneath the table. Turning the handle rapidly adjusts the table to any desired height, accurately lining up the motor shaft with the dynamometer coupling. The yoke is notched on the sides so that any desired clearance can be selected, and a worm clamp is raised or lowered by means of a handle at the top. This arrangement permits wide latitude in the size of motors to be tested, and the various adjustments can be made easily and rapidly.

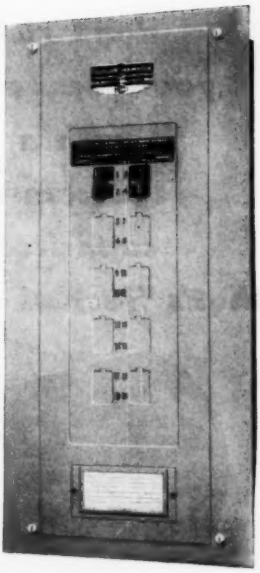
A foot pedal controls the operation of the dynamometer motor, permitting the operator to use both hands for other purposes, and the dials on the testing panel are large and well-illuminated for clear, accurate reading.

SINGLE POLE
The Multi-Breaker for minimum needs. Ask for MO1

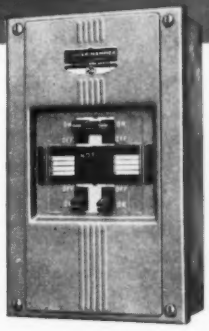
TWO POLES
The Multi-Breaker for small homes. Ask for MO2

FOUR POLES
in a single block.
One and two pole combinations. Ask for MO4

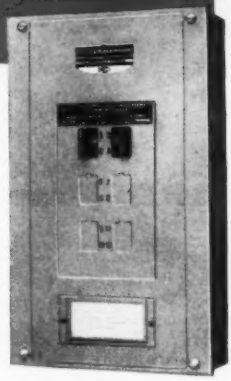
Everything you need
Everything you want
in just 6
Cutler-Hammer Multi-Breakers



4 POLES BASIC
UP TO 20 POLES
Made by adding four-pole "plug-in" units. Ask for MO20



4 POLES BASIC
5-6-7-8 POLES
Made by adding single pole units. Ask for MO8



4 POLES BASIC
UP TO 12 POLES
Made by adding four-pole "plug-in" units. Ask for MO12

UP TO 20 CIRCUITS FOR ALL DOMESTIC PROTECTION NEEDS

These six Cutler-Hammer Multi-Breakers that provide from one to 20 circuits meet all domestic protection needs . . . small homes, medium size homes and large homes. The fundamental unit is a block with four single pole breakers of various capacities. These blocks (plus the use of single pole "ad-ons") can be combined to provide any combination as shown in the pictures above. You carry a small stock and you make up the Multi-Breaker you want—*for* the job—*on the job.*

These Cutler-Hammer Multi-Breakers offer you and your customer every wanted feature . . . circuit interrupter that needs only the touch of a little lever to restore service, "slow-fast" *thermal magnetic* element that is slow to act on safe overloads but acts instantaneously even on low value short circuits (a standard feature that is provided at no extra cost), safe, factory-sealed mechanism, attractive appearance that harmonizes with modern architecture . . . and world-famous Cutler-Hammer dependability. Carried in stock by reliable wholesalers everywhere. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin.

CUTLER-HAMMER
MULTI-BREAKER
C-H

Genuine Joe says:

don't risk your reputation with a replacement capacitor that's "just as good"

Be RIGHT with genuine Wagner capacitors

Why take chances with capacitors that are "just as good" in everything but performance. When new motor-starting capacitors are needed, always replace with genuine Wagner Capacitors. You'll be *right* every time—on size—on mounting brackets—and on the same high quality, as the original capacitor.

The capacitor number, stamped on Wagner Motor nameplates, is an easy, accurate guide that assures the right selection.

Write for Wagner's Fast-Moving Parts Bulletin, MU-122, and for Motor Parts Catalog MU-40. Every repair shop needs these helps.

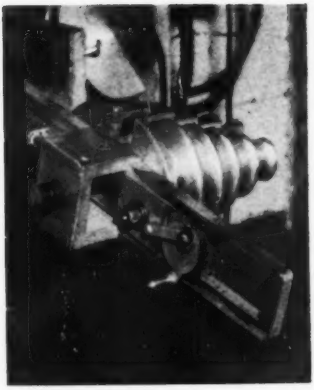
Wagner Electric Corporation 1891 1951

WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U. S. A.

MOTORS · BEARINGS · STANDARD ROTORS
BRUSHES · CAPACITORS · COMMUTATORS

650 AUTHORIZED SERVICE STATIONS OR PARTS DISTRIBUTORS

MU51-12



CONTROL CAM rotates inward when mush coils are wound, releasing pressure and permitting the rapid removal of the formed wire coils.

Collapsible Form For Mush Coils

Mush coils are formed and removed from the form easily in the shop of the Tennessee Electric Motor Service of Knoxville. The reason is a collapsible form, which can be condensed in size merely by revolving a cam which releases the pressure on the cast aluminum mush-coil grooves. Turning the small handle on the cam moves the segments of the form towards each other, shortens the distance around the periphery of the grooves, releases all pressure and permits the ready removal of the formed coils.

R. E. (BOB) WARD, founder-owner of the Electric Motor and Repair Company, maintains that the service industry is a three-partner arrangement between the shop, the customer and the company employees. Honesty among all three is essential if one is to work with, rather than for the others. This policy has resulted in the 22-year growth of the company from a 4-man outfit to a 3-plant, 100-man organization in Raleigh and Fayetteville, N. C., Columbia, S. C.

Raceway with the chemical-proof hide . . . .

ELECTRUNITE "Dekoron-Coated" E.M.T.

PROTECT RACEWAYS from the expensive, corrosive attacks of industrial chemicals and atmospheres. Install ELECTRUNITE "Dekoron-Coated" E.M.T. wherever ordinary raceways must be replaced because of damaging corrosion.

An extruded coating of polyethylene provides regular galvanized ELECTRUNITE E.M.T. with a tough hide that's impervious to almost everything from salt spray to hydrofluoric acid. This coating is not injured by tools, since standard threadless compression joints avoid the need of turning the raceways. The standard compression couplings are easily wrapped with a polyethylene or vinyl-backed electrical tape to assure full end-to-end protection of the entire raceway installation.

ELECTRUNITE "Dekoron-Coated" E.M.T. is the only threadless steel raceway providing an added protection of polyethylene over the galvanized coating.

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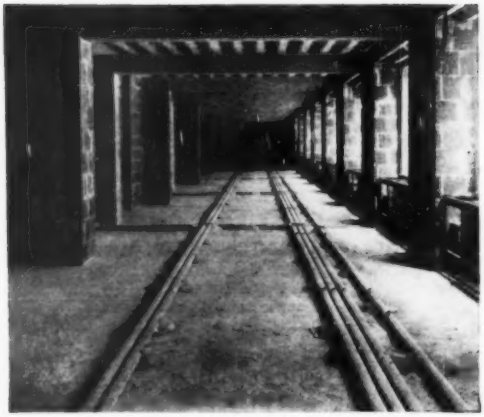
STEEL AND TUBES DIVISION
224 EAST 131st STREET • CLEVELAND 8, OHIO

FREE BULLETIN
describes ELECTRUNITE "Dekoron-Coated" E.M.T., tells where and how to use it. Write today.

Republic
REPUBLIC STEEL
ELECTRUNITE
"Dekoron-Coated" E. M. T.

LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY



G-E Fiberduct raceways provide single-, double-, or triple-duct service—can be laid in a variety of patterns to concentrate distribution over any portion of floor.

Large G-E Fiberduct raceways provide ample facilities for the heaviest electrical demands—permit installation of outlets right where they're needed in a few minutes.

Provide Complete Underfloor Distribution with nonmetallic G-E Fiberduct Raceways

Plan now to avoid materials problems and still provide ample underfloor distribution with nonmetallic G-E Fiberduct raceways.

G-E Fiberduct raceways offer the kind of over-all distribution that today's expanding electrical requirements demand. They put power where it's needed when new electrical equipment and changing floor layouts call for flexible distribution.

Fiberduct raceways make it easy to install additional outlets at all times. An electrician cuts a hole through the floor and the duct, pulls wires through and installs the outlet. New distribution is provided by merely pulling additional wires through the raceway. There's no interruption of building facilities . . . no annoyance to building tenants!

Complete specifications and installation data are available from your General Electric Construction Materials distributor. For a free copy of the G-E Fiberduct Data Manual, write to Section C57-818, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

To add an outlet, simply make a small opening in the floor over the raceway, fish wires through, connect outlet.

Fiberduct Underfloor Raceways

You can put your confidence in—

GENERAL ELECTRIC

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Here's how to get manufacturers' information as ***QUICKLY*** as possible.

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Describe the product or literature in the space provided. Use trade-names, name-plate data, bulletin numbers and titles, etc. Give the number of the page on which the item is mentioned, and fill in the month of the issue.

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330 West 42nd St.,
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Electrical Construction and Maintenance is written for you by a large staff of editors and consultants, each an authority on some phase of the business. They will be glad to give you expert advice and answers to your questions.

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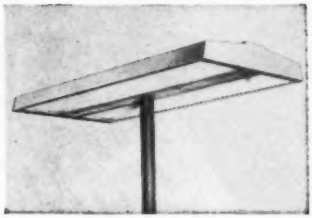
TO ASK THE EDITORS USE THIS CARD

For information on New Products or New Literature —

See other side of this page.

Product News



Service Station Light (1)

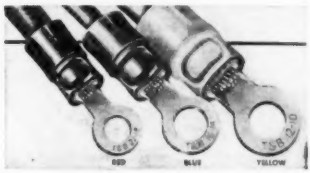
A new design in service station lighting equipment has been developed. The fixture is mounted in a horizontal position to direct light from its six 40-watt fluorescent lamps downward over a wide working area. Any vertical supporting unit, such as an existing pole which has been used for mushrooms, is adequate for the purpose, or the fixture can be suspended under canopies or from bracket arms. The "T" light provides a high intensity output of low surface brightness, is equipped with instant start ballasts and lamps, and is listed by Underwriters' Laboratories, Inc. Ballasts are cooled by air circulation through ventiducts. Fixture is constructed of heavy gauge steel sections with cast aluminum ends, and is provided with knockouts in top for mounting of sealed beam lampholders or for suspension purposes.

Guardian Light Company, 201 Lake St., Oak Park, Ill.

Bus Duct (2)

Four standardized types of bus duct for a variety of industrial power distribution system applications are available. Types included are: plug-in duct for branch runs, providing power takeoff outlets every 12 inches; weatherproof feeder duct for outside runs (transformers to switchgear); low-impedance duct for long feeder runs, or where minimum voltage drop is important; and, weatherproof low-impedance duct for runs between transformer and switchgear, where duct must withstand high short-circuit stresses. All types except weatherproof feature channel construction of the top, sides and bottom for maximum rigidity. Bus bar points are silver plated.

Westinghouse Electric Corp., Pittsburgh 30, Pa.



Terminals (3)

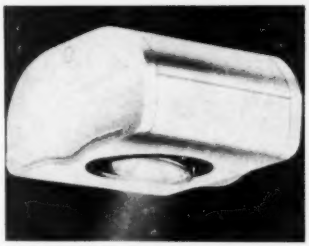
A new line of terminals, known as self-insulated Sta-Kon terminals, has been announced. Units are integral, one-piece assemblies combining a metallic portion that grips both the wire and the wire insulation tightly and permanently, with a single staking operation; and a translucent, firmly anchored terminal insulator of specially formulated nylon. Advantages are: longer electrical creepage path, due to built-in air gap between terminal insulator and wire insulation; unique anchoring of terminal insulator by a combination of press fit and outward flaring of metallic portion; deep socket for wire insulation; and novel formulation of terminal insulation.

The Thomas & Betts Co., Incorporated, 78-A Butler St., Elizabeth, N. J.

Elevator (4)

A new WACO portable elevator has been announced. It features a rigid triangular tower and automatic reverse control. It can be powered by either gasoline or electricity and is designed to support its entire load on its four rubber tire wheels. Designed for use by general contractors, electrical contractors, acoustical contractors, plumbing, heating, roofing, air-conditioning contractors, and industrial plants, platform may be preset to stop at desired loading and unloading level by means of remote control mechanism.

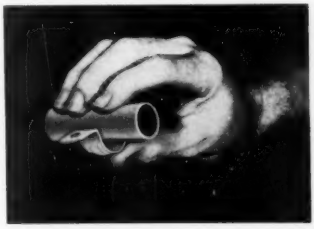
Wilson-Albrecht Co., Inc., 3565 Wooddale Ave., Minneapolis 16, Minn.



Spotlight (5)

A new Mid-Century spotlight, Model No. 361, is designed for inline mounting with all Mid-Century commercial fluorescent luminaires or for individual mounting in any lighting system. It provides "down-punch" lighting for merchandise display and accent illumination, and for highlighting in store interiors, display rooms, show windows, offices, etc. Units may be mounted between Mid-Century fixtures, or at the ends of rows. Ornamental end-pieces are attachable for individual mounting. A PAR-38 projector spot or flood lamp is employed, and a gimbal ring mount permits easy adjustment of beam in all directions. It measures 10 inches long, 14½ inches wide and 6¾ inches deep. Unit has been approved by Underwriters' Laboratories.

Mitchell Manufacturing Co., 75 East Wacker Drive, Chicago, Ill.

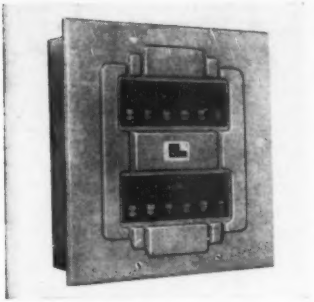


Conduit Strap (6)

A new on-hole conduit strap which snaps onto conduit and holds in position has been introduced. Called the "Snap-Strap", it is made of heavy gauge steel, zinc plated after fabrication. Can be welded to steel supports. They are available in ½, ¾, 1 and 1¼ inch sizes for both rigid and thinwall conduit.

Blackhawk Industries, Dubuque, Iowa

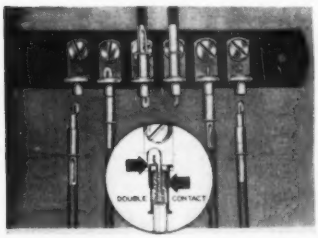
SMOOTH SAILING
MODERN FITTINGS FOR
• thinwall conduit
• rigid conduit
• metallic and non-metallic cable
• flexible steel conduit
• service entrance cable
• grounding devices
• lighting fixture fittings
midwest
manufacturers for over 30 years
representatives in principal cities
Sold Through Electrical Wholesalers
MW
midwest electric mfg. co. • 1639 walnut st. • chicago 12, ill.



Circuit Protector (7)

A new circuit protector with a capacity of twelve circuits, featuring fully magnetic action in each breaker has been announced. The magnetic action makes it impossible for the breakers to trip due to external or internal heat. Standard package of "12" circuit protector consists of four 15 amp breakers plus two 20 amp. breakers with provision for six additional breakers. Six pairs of handle extensions are supplied. No main switch is required ahead of the "12" and "8" circuit protectors, providing the number of operating handles is limited to six by the use of handle extensions. Individual breakers are interchangeable with other new single pole individually housed breakers.

Murray Manufacturing Corp., 1250 *Atlantic Ave., Brooklyn* 16, *N. Y.*



Connector (8)

Announcement has been made of a new type of electronic connector. Straight insertion at the terminal locks the plug securely in its outlet. The contact parts themselves form the lock, and the locking engagement is positive as well as shock and vibration proof. Removal of the plug is simple. A slight pull on the flanged sleeve releases the locking mechanism and the plug in one operation. The special electrical feature of these connectors has been called "Double Contact". First, there is frictional contact. Secondly, there is knife-edge contact effected by the locking contacts in plug and outlet, and held under constant coil spring pressure. Plugs and outlets are suitable for all wiring connections and terminal strips. The connector is rated at 10 amps, 110 volts.

Harvey Hubbell, Inc., Bridgeport 2, Conn.

Vertical Motors (9)

New vertical, solid-shaft capacitor motors, featuring standardized mounting dimensions, have been added to the Tri-Clad motor line. They are available in ratings from ¾ to 5 hp. Principal application is on jet pumps and other assemblies for supplying water to homes and farms, and for irrigation. They are suitable for outdoor operation where severe climatic conditions are not encountered. Tri-Clad construction provides motors with protection from physical damage, electrical breakdown, and operating wear and tear. Dimensions of Type P base, are the same as those of polyphase motors of same size, permitting interchangeability without modification of mounting.

General Electric Company, Schenectady 5, N. Y.

Instrument (10)

The dual purpose Model A-30 sensitizer, which combines the service of the original 10x sensitizer and the 1x split plug in one instrument, has been announced. It is changed from one to another by means of a two-position switch. This model, designed for easier readings on small appliances and motors of ½ hp or less, multiplies the sensitivity of the Amprobe ten times. This accessory adds three low current ranges to the Model A-6 amprobe—0-1 amp, 0-2.5 amps, 0-5 amps. A shift of the 2-position switch and the change is made to the 1x split plug, which does not increase the sensitivity, but facilitates snap-on current readings of equipment having

sealed double-conductor electric cord. When plugged in between the equipment being checked and the outlet, it separates the conductors without touching the wire.

Pyramid Instrument Corp., 49 *Howard St., New York, N.Y.*

Ground Alarm (11)

This new Allen ground alarm is a fault signal device which functions only when a ground fault is on the line of an ungrounded power distribution system. It operates on a balanced bridge circuit and can be adjusted to any ground fault resistance from zero to 8,000 ohms under normal conditions. The unit consumes less than 50 watts of power; requires no maintenance (except tube check every six months); allows maximum protection to power equipment; will operate up to 10 signal stations (horns, lights, bells) installed throughout the plant (number of stations depends upon relay capacity). Signal device voltage can be 115 to 24 volts; relay capacity is 3 amperes. Unit available in 110, 220, 440-volts single or three-phase; 250 or 500 volts direct current; can be furnished to operate on 25 cycle and higher voltage circuits on special order. Alarm can be used separately or in connection with Allen ground detector.

Excel Electric Service Company, Inc., 2125 South Western Avenue, Chicago 8, Illinois.

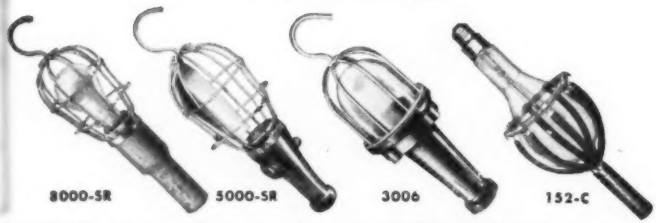
Unsurpassed for Quality

McGILL®
5025 SLR
GUARD

with lens, reflector, convenience outlet

Portable Lamp Guards under the trade mark McGILL have been accepted with assurance of superior design, materials and workmanship for over 40 years. A reliable guarantee of greater dependability and longer life in industrial service.

The new No. 5025-SLR beams light to inaccessible places through an end lens. Has 15 Amp. 125 volt power tool outlet in phenolic plastic handle. Levolier switch, reflector, grease and heat resisting cord. Underwriters' Laboratories Inspected.



No. 8000 SR Guard is a fine general service guard, identical in construction to the 7000 rubber handle Series, except equipped with stout polished birch wood handle. Cages are of extra heavy steel wires, electrically welded and heavily zinc plated.

No. 5000 SR Guard—features the new approved, phenolic plastic handle with convenience outlet and Levolier switch. Closed end cage for 100 watt bulb.

No. 3006 VAPORPROOF GUARD — Designed to provide absolute protection wherever portable lighting must be watertight, dust-tight and moisture proof. A heat and impact resisting glass globe screws into a rubber gasket. Plastic handle sealed with a diaphragm washer.

No. 152-C LAMP CHANGER—for 100 watt bulb. Other types of changer heads are available. New light-weight steel pole is furnished in 5½ ft. sections, insulated, extends to reach a recommended maximum of 30 feet.

AVAILABLE FROM YOUR ELECTRICAL WHOLESALER

For New Catalog No. 49 Write: McGill Manufacturing Co., Inc., 450 N. Campbell St., Valparaiso, Ind.

McGILL®
electrical specialties

ONLY McGILL MAKES *Levolier* SWITCHES

Conduit Hangers (12)

Announcement has been made of a new low cost line of conduit hangers for installing single runs of electrical conduit. Known as B-Series, a single run of conduit can be hung from structural steel I-beams, channels, angles or columns, or from concrete inserts or wood-frame buildings. The series consists of seven basic devices which assemble easily into many different combinations. They are interchangeable and re-usable. Whenever relocation of lights, power-driven machinery, etc. is necessary, conduit runs can be taken down and hangers re-used in the same or different combinations.

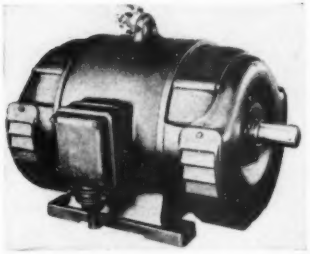
Kindorf Co., 4060 Harlan St., Emeryville 8, Calif.

Service Entrance (13)

Two new types of 100 ampere fusible service entrance equipment have been introduced. The series types utilize a new 100 ampere fusible pullout disconnect which controls all branch circuits. These devices are available with two 220 volt, 30 or 60 ampere branch circuits for range, water heater, dryer, etc. and either 8, 10 or 12 plug

fuse, 110 volt circuits for such loads as lighting, furnace, kitchen and laundry. The parallel mains types connect the three 220 volt, 30 or 60 ampere pullout circuits in parallel, thus eliminating the need for a main disconnect. One of the pullouts control 4, 6 or 8 plug fuse, 110 volt circuits for such loads as lighting, furnace, kitchen and laundry. The other pullouts control the range, water heater, dryer or other 220 volt circuits. Flush and surface type covers are interchangeable.

Square D Company, 6060 Rivard Street, Detroit 11, Mich.



Motor (14)

A new Quick-Stop motor which is a combination brake-and-drive all-in-one unit has been announced. It is specially designed for use as initial equipment or for replacement where frequent starts and stops are required. No outside power source or special controls are needed for applying or releasing the brake. Mounting may be horizontal or vertical for forward or reversing operations. Available from .3 to 8 hp. in drip-proof and .2 to 4 hp. totally enclosed. Recommended for such applications as setting-up, adjusting and feeding motors of large machine tools, winches, hoists, cranes and other drives requiring frequent starts and stops without creep or backlash.

Brown Boveri Corporation, 19 Rector St., New York 6, N. Y.

Load Centers (15)

Unique construction and packaging of the new line of Trumbullite load centers enable the distributor and contractor to maintain a complete range for residential and commercial applications with minimum stocks. One and two circuit load centers are shipped assembled. Four through 20 are shipped in such a way that they can assemble a completed device to satisfy any requirement. The enclosure, consisting of box, interior and two 15 amp circuit breakers, is placed in one

FULLMAN Latrobe PRODUCTS

FLOOR BOXES ★ WIRING SPECIALTIES

FULLMAN MANUFACTURING CO. QUALITY LATROBE SUPREMACY LATROBE, PA.

DEPENDABLE PERFORMERS

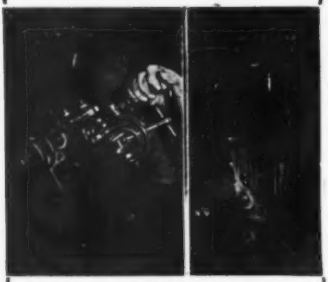
For long, smooth service "Latrobe" Floor Boxes and Wiring Specialties are tops. Years of performance have proved that.

"Latrobe" Boxes are designed in a way that permits fast, easy installation—cutting labor costs to the bone.

No. 252-R "Latrobe" Two Gang Adjustable Floor Box
No. 284 Nozzle No. 200 Cover Plate
No. 280 Nozzle No. 200 Cover Plate
Fullman "LATROBE" PRODUCTS Supreme Quality
No. 110 "Latrobe" Non-Adjustable Watertight Floor Box
Keystone Fish Wire
No. 150 Box— No. 207 Nozzle
Sold Only Through Wholesalers

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

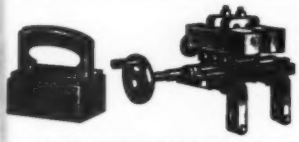
MARTINDALE
COMMSTONE HOLDERS



Hold Commstones rigid and true for concentric re-surfacing of commutators and slip rings while running at normal speeds in their own bearings. Interchangeable boxes 1", 2" and 3" wide handle grinding jobs up to 4¼" wide.

BLOWERS AND VACUUM CLEANERS

MARTINDALE COMMSTONES AND COMMUTATOR GRINDING TOOLS



MICA UNDERCUTTERS FOR SLOTTING COMMUTATORS

Nine Motor Driven Types HEAVY DUTY ETCHER

Mark motors and other equipment with service data. Three other styles available.

Write for 64-page Catalog describing these and many other products for Industrial Maintenance, Safety and Production.

MARTINDALE ELECTRIC CO.
1309 Hird Ave. Cleveland 7, Ohio

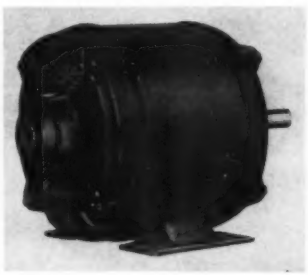
carton. Fronts, surface or flush, are packaged in individual envelopes. Each load center front is provided with two punched breaker openings; additional circuits are added by removing twist-outs. Circuit breakers which are interchangeable in all ampere ratings, are individually packaged.

Trumbull Electric Mfg. Co., Plainville, Conn.

Service Lights (16)

Announcement has been made of new Protex service lights. 110 volt lights Nos. 611 and 612, 7 and 15 watts respectively, are built for handy inspection and service of metal castings, business machines, electronic equipment, etc. Lamp has Neotex oilproof handle, 10 ft. cord and removable fiber guard reflector which gives a two-directional light beam.

Daniel Woodhead Co., 15 N. Jefferson St., Chicago, Ill.



Motor (17)

Announcement has been made of a new "Special Service", split phase, fractional hp motor. It has a high starting torque for use where high starting current is not objectionable. Features include: rigid cast-iron end brackets of drip-proof design; rigid welded steel frame; feet welded to frame, and held to accurate shaft height dimension; thick-walled phosphor bronze sleeve bearing with thrust collar; wool yarn lubrication with reserve oil capacity. Motors can be furnished with cushion base.

Century Electric Company, 1806 Pine St., St. Louis, Mo.

Lamp Bulb (18)

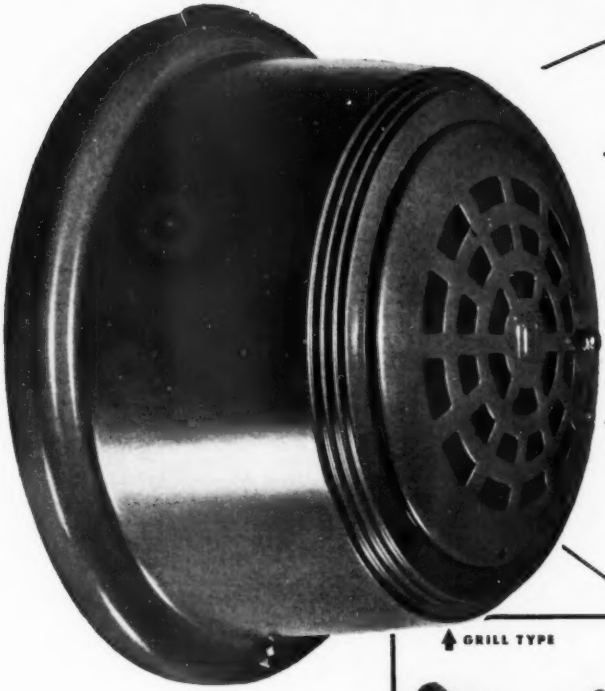
A tiny lamp that dissipates odors through a triple output of ozone-inducing radiations has been developed. The new "Odorout" bulb changes odor molecules in air instantly. This occurs as ultraviolet radiations of special wavelength transform the oxygen around the lamp into ozone, an air purifier. The 3½ watt, walnut-sized lamp, when burned in a special wall fixture, destroys cooking, smoking, dampness, mildew and perspiration odors. It is recommended for use in kitchens, living rooms, dining rooms, bedrooms, basements, clothes closets and medicine cabinets, and in physicians', dentists' and business offices.

Westinghouse Lamp Division, Bloomfield, N. J.

Bronze Bearings (19)

An enlarged and improved line of bronze bearings and bushings has been announced. Bearings range from small sizes up to sizes as large as 24 inches in diameter. Available in a variety of types—plain, flanged, split or any combination. Finishes ranging from an accurate machine finish for precision application to a semi-finish for rough work are now available. They incorporate special lubrication designs to meet individual requirements. The flanged type of bearings and bushings are provided not only in all finishes with standard flanges but also with special flanges, to order.

Bronze Bearings, Inc., 478 North Ave. E., Cranford, N. J.



Here's a horn worth blowing about!

GRILL TYPE

PROJECTOR TYPE

(Flush type horn also available)

New Edwards ADAPTAHORN is Tops in Performance, Economy, Appearance

Take every horn problem you've ever had—here's the answer to all of them! Check the new and distinctive features offered by Edwards new Adaptahorn —you'll agree it was designed with your next job in mind.

Cleanly, simply designed . . . like all Edwards equipment . . . the Adaptahorn is easiest of all to install . . . saves time, trouble, man-hours . . . nets you a bigger profit on every job. A sure fire customer-pleaser, too.

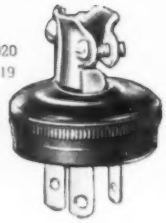
Made of rugged zinc die-casting, no other horn can match Adaptahorn's loudness with such low current consumption . . . an important point to the user. Let Edwards' 79 years of experience work for you. Install Edwards new Adaptahorn for your next fire alarm, program control or locator job. There's no horn like it! For proof, write Dept. E-8, Edwards Company, Inc., Norwalk, Conn.

Only Edwards New Adaptahorn Offers All these Profit-Making Features

1. Outstanding finish and appearance.
2. Greater carrying tone at minimum current.
3. Rugged, shock-proof . . . die-cast housing.
4. Non-adjusting. Subjected to severe life tests without failure or need for adjustment.
5. Muting feature standard in all models.
6. Interchangeable with 6" and 10" Adaptabels on same mounting plate.
7. Weatherproof construction.
8. Front wiring and plug-in type connection . . . No "juggling" when installing.
9. Elongated mounting holes for easy alignment.
10. Female receptacle on mounting plate eliminates exposed "hot" points.
11. Can be mounted on all standard outlet boxes.
12. Listed by Underwriters' Laboratories.

EDWARDS

World's most reliable time, communication and protection products



No. 5020
No. 5019
less
clamp

NEW and IMPROVED!

3 wire polarized flush Receptacle and Cap in black bakelite

...another ***heavy duty*** *product*
in the ***5000 Series***
Rated: 15 A.-125V.; 10 A.-250V.

No. 5026
No. 5026-G

No. 5027
No. 5027-G

No. 5024
No. 5024-G

RECEPTACLE

One piece heavy bakelite; double contacts; three large terminal screws; underslung heavy steel strap; permanently riveted assembly; "G" type is grounded to strap with only two terminal screws for wiring. Fits standard **Leviton** wall plate No. 1904

CORD GRIP CAP

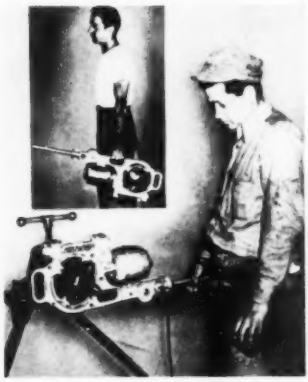
For .460 in. diameter cable; 2-screw steel clamp; 1½ in. outside diameter; solid brass blades; three large terminal screws

LISTED AS STANDARD BY UNDERWRITERS LABORATORIES, CANADIAN STANDARDS ASSOC. AND MEETS R. E. A. SPECIFICATIONS.

LEVITON

LEVITON MANUFACTURING COMPANY
BROOKLYN 22, NEW YORK
warehouses: Chicago and Los Angeles

OFFICES IN ALL PRINCIPAL CITIES



Pipe Threader **(20)**

A new portable power pipe threader, called the Port-A-Pony, for threading ¼ inch to 4 inch pipe on the job, has been developed. All popular types of hand die stocks are adaptable. Dies can be changed, seated and locked in place in a matter of seconds, increasing the adaptability of the unit. Additional speed in operation is obtained by the ½ hp, 110 volts ac or dc reversible electric motor which removes the Port-A-Pony from finished threads by the flip of a switch. It cuts clean, leak-proof threads wherever the working area is 12 inches. It can be used to cut stationary pipe in narrow trenches, well pits, ditches, overhead areas and within five inches of walls.

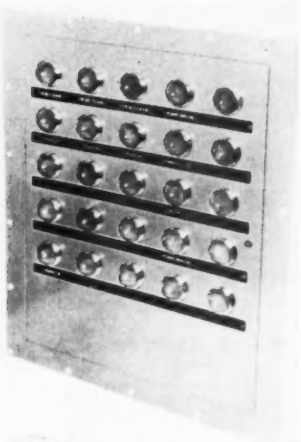
Thread-Ezy Mfg. Co., Corunna, Mich.

Remote Control Unit **(21)**

A new remote control unit, called "Sensivolt", provides a static ac voltage sensitive control capable of differentiating small changes in ac voltage and handling large amounts of power. Basis of operation is a resonant elec-

trical circuit similar to a constant-voltage transformer. Operating circuit consists of three windings—a primary winding, a secondary winding, and a relay coil resonating in series with a capacitor. Magnetic circuit is a closed core provided with a magnetic shunt. Listed as possible applications are: combination with a power relay and resistor as a switching device; step by step voltage regulation; low line voltage control to start auxiliary or stand-by equipment; protection of motors and electrical equipment from low or high line voltage; remote control by line voltage modulation; control of several selective voltage circuits from a single variable voltage source; firing of thyratron circuits.

Sola Electric Company, 4631 West 16th Street, Chicago 50, Illinois.



Lamp Annunciators (22)

Announcement has been made of heavy-duty lamp annunciator, Type ANN18, using lamp units with two inch beehive lenses, and engraved lamicoid designation strips. The relays are "plug-in" type and are mounted directly to the rear of the lamp units. For all voltages up to 250 volts, ac or dc. For use with S6 and T2 type bulbs. Also available with two inch diameter flat lenses, for indication markings, to eliminate designation strips. Automatic service provides an audible signal as well as a visual signal, and the cutting off of the audible signal for one section does not prevent the receiving of the audible signal from any other sections that may become abnormal.

H. R. Kirkland Company, Morristown, N. J.

IN NO OTHER BODY *Do You Get All This*

HUSKY, WIDE and HANDSOME

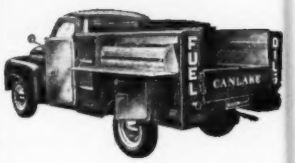
Carry-All's exclusive design and its extensive tooling and engineering make possible heavy gauge steel construction (with the correct gauge for each component) and a unique bridge-type underbody . . . these make possible huskier construction with lighter over-all weight and fewer number of parts *than any comparable body on the market*— that's why the MORRISON *Carry-All* has greater carrying capacity for gross vehicle ratings!

POSITIVE PROTECTION AGAINST WEATHER and THEFT

The center control dual latch locking arm effectively seals the double stamped and embossed door panels against the specially molded rubber gasket to make a completely weatherproof and weathertight closure. The forged chrome-plated handles are recessed for safety as well as appearance, and the entire mechanism is protected against theft by an individual cylinder positive action type lock on each door—keyed alike.

A DESIGN FOR EVERY ELECTRICAL JOB

The MORRISON *Carry-All* is designed for ready adaptation to any job . . . Morrison made provisions in the basic design for and has made available a selection of specialized accessories, so that the basic body can be easily adapted for any purpose in the electrical industry!



LOWER INITIAL COST— NO MAINTENANCE COST

Each dollar saved on your initial investment is matched by *lower depreciation and no maintenance costs* . . . the MORRISON *Carry-All's* die-stamped steel, electrically-welded construction is rugged enough to outlast two or three chassis and can be easily transferred from one chassis to another.

The MORRISON Carry-All is carried in stock for immediate delivery to franchised chassis dealers by 60 established truck equipment distributors from coast to coast.

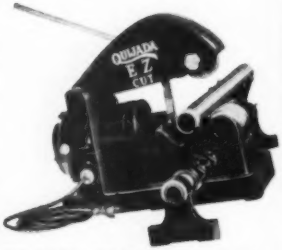
MORRISON STEEL PRODUCTS, INC.
Carry-All Body Division
639 AMHERST ST. BUFFALO 7, N. Y.

QUIJADA
SAY "KEE-HAH-DAH"

IN CUTTING & THREADING CONDUIT — BOLTS — TUBING HERE ARE THE

SPEED CHAMPS

QUIJADA "Chief" Portable Pipe & Bolt Threader. Patented automatic chucking. Range ½" to 2". By comparison, the fastest threader on the market.



QUIJADA "E-Z" Cutter. Capacity ⅛" to 2" pipe & tubing. Easiest, fastest & cleaner pipe & tube cutter ever designed.

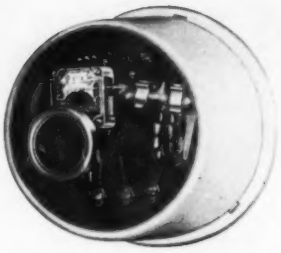
SPEED of operation, work EASE and general day-in, day-out CONVENIENCE are outstanding characteristics of these famous Quijada machines. It doesn't matter whether they're used as portable equipment or mounted permanently in the shop, men LIKE to work with them. That's the story from all quarters.

First With The Finest for 27 Years in Cutting & Threading Machines

Sold only through jobbers.
Write for complete information.

The Factory Welcomes a Note from You.

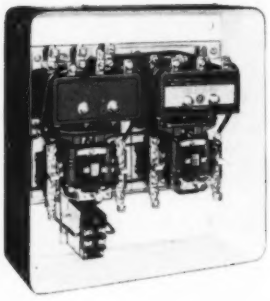
QUIJADA
TOOL COMPANY, INC.
5474 Alhambra Ave.
Los Angeles 32, Calif.



Illumination Control (23)

A new weatherproof illumination control of the plug-in type has been announced. Known as Model 1089, the unit provides automatic "on-off" control of artificial lighting at predetermined light levels. It is recommended for street lighting, sign lighting, industrial lighting, as well as for controlling lights on obstruction markers, airway beacons and air strips. Unit, mounted in a standard weatherproof watt-hour meter glass case, consists of a dry-disc type photocell, a sensitive relay which is operated directly by the photocell, a clock motor, mercury switch and limit switch. It contains no phototubes or vacuum tubes; requires no stand-by power; and has no resistors or capacitors.

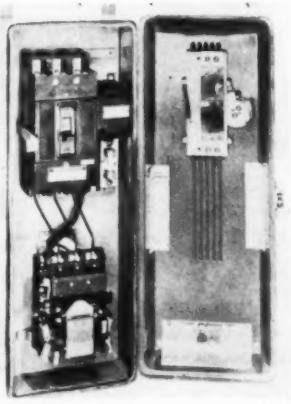
Weston Electrical Instrument Corp., 641 Frelinghuysen Ave., Newark 5, N. J.



Starters (24)

Announcement has been made of a new ac part winding starter, Bulletin 736, for use with motors which employ two separate parallel windings, star or delta, to obtain increment starting. Starter consists of two across-the-line starters and a pneumatic timing mechanism mounted below one starter and operated by the starter's solenoid plunger. Pressing the "start" button immediately closes the first starter which energizes one of the two parallel windings. Meanwhile, the timer is in operation and after a few seconds energizes the second starter. With both starters closed, full line current is supplied to motor through both windings, each using 50% of the total current drawn.

Allen-Bradley Company, Milwaukee, Wis.



Starters (25)

Improved starting and control of machine tools, presses, and other equipment used in mass production industries is provided by the new combination life-linestarter (Class 11-206-NJ) Unit is available in NEMA sizes 1 through 5, with ratings up to 200 hp, 440 volts polyphase. Starter's NEMA type 12 enclosure has a continuous neoprene gasket and is mounted by external brackets. Breaker is operated by a slam-proof, self-indicating external handle, but the enclosure must be opened to reset overload relays, which brings motor overload to authorized person's attention. Starters are furnished as standard with a 220/440-volt primary, 110-volt fused secondary, control circuit transformer that can be used on either 220 or 440 volt supply voltage, 50 or 60 cycle.

Westinghouse Electric Corp., Pittsburgh 30, Pa.

Intercommunication Station (26)

Announcement has been made of an intercom Staff station incorporating a "Privacy" lamp that permits the user to answer calls from across the room, and at the same time enjoy protection from eavesdropping. The user of the Staff can be at the far side of the room, even 20 or 30 feet away from the sta-

Greater Savings . . . . . through Simplified Design in Cope Cable Trough Installation

To save material is of the greatest importance to our Defense Effort. We daily read of cuts in allotment of materials for "non-essentials." And when essential equipment—such as Cope Cable Trough—saves material, not only our government but naturally all industry is interested. That's why so much Cope Cable Trough is being used by outstanding Utilities, Industrial plants and Government agencies.

By using standard Cope Cable Trough and Fittings—turns, branches, reductions, vertical as well as horizontal runs that can be so easily assembled—waste of materials during installation in the field are eliminated. For the same reasons, countless man-hours are saved in installation time.

If unusual problems of installation arise, the Cope Engineering Staff is at the service of customers to help design special fittings.

Since it is the duty of everyone to conserve—and since Cope Cable Trough saves material, labor and costs—you will want a copy of our latest Bulletin describing Cope Cable Trough. Won't you write for it today?

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T. J. COPE, INC., 711 SOUTH 50th ST., PHILADELPHIA 43, PENNSYLVANIA

TAILOR-MAKE YOUR OWN

CONDUIT OR PIPE BENDS

RIGHT ON THE JOB

. . . simple, quick with the

GREENLEE HYDRAULIC BENDER

Yes, quickly make bends *exactly* as you want them, when you want them, where you want them. Compact, portable GREENLEE Hydraulic Pipe and Conduit Bender lets you do this in a jiffy. *One-man operated* to produce smooth, accurate bends in just a few minutes . . . in pipe up to 5", rigid and thin-wall conduit, tubing, bus-bars. Owners report timesavings up to 60% and more, elimination of cost for manufactured bends and fittings, and "clean", tailor-made installations every time. Get facts now on this time-saving tool that often pays for itself on first few jobs! Write for free Bender Booklet, Greenlee Tool Co., 1748 Columbia Avenue, Rockford, Illinois.

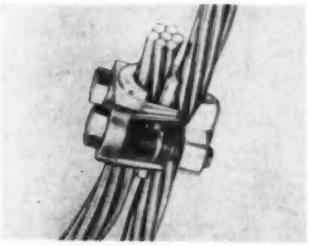
TOOLS FOR CRAFTSMEN

GREENLEE

Other GREENLEE timesaving tools for electrical work: Hand Benders; Joist Borers; Cable Pullers; Knockout Tools; Auger Bits and Drills.

tion, and hear and reply to all incoming calls without stopping his work to approach or operate the station. The instant a master station opens the line to call the Staff, a visible red lamp, located on the lower left hand front corner of the Staff station, illuminates, notifying the user that the line is open. Staff station is 6½ inches high, 6 inches wide, and 3½ inches deep at the base.

Executone, Inc., 415 *Lexington Avenue, New York* 17, *N. Y.*



Connector (27)

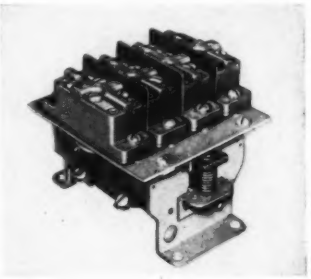
Announcement has been made of a new, spacer type, two-bolt connector. Two sizes are in production, providing a range of conductor sizes 2/0 to 2/0 in the smaller and 4/0 to 4/0 in the larger, including intermediate conductor sizes. Connector design permits assembly to conductors in one piece. Machine bolts have bronze retainers. Space is free floating and is secured to one of the bolts by a staked copper "U" wire.

Reliable Electric Co., 3145 *Carroll Ave., Chicago* 12, *Ill.*

Foot Switch (28)

Announcement has been made of the development of a new "Linemaster" Lektro-Lok foot switch. A mechanical interlock prevents both circuits from being operative at the same time. It operates on a teeter-totter principle with selective circuits. Pressure on one side opens or closes line. Release of pressure returns switch to normal off position, independent of first. Both interiors can be wired normally open or normally closed. Model L-2-S is single pole, double throw, ac 20 amps, 115 volt, 10 amp, 230 volt interiors.

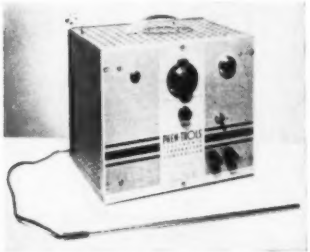
Simonds Machine Co., Inc., Southbridge, Mass.



Relay (29)

A new four-pole relay has been announced. Designated as Class 8501 Type PO4, it makes available a line formerly obtainable in a maximum of three poles. It is suitable for control assemblers, having all terminals exposed, being easily accessible, and occupying only a small space on the panel. Device has four normally-open and four normally-closed contacts, allowing circuit arrangement to be changed by changing incoming wires to different terminals. When used in circuits of same polarity, four normally-open and four normally-closed contacts are available. All contacts are silver-to-silver. Relay is rated 10 amperes non-inductive, with inductive ratings of five amperes at 600 volts, 15 amperes at 110 volts. Coils are available for 6-600 volts, 25-60 cycles.

Square D Company, 4041 *North Richards St., Milwaukee* 12, *Wis.*



Controller (30)

Announcement has been made of a new electronic temperature controller for use in laboratories and industry where close control of critical tempera-

Resistor FAILURES COST MONEY!

LOST MACHINE TIME...

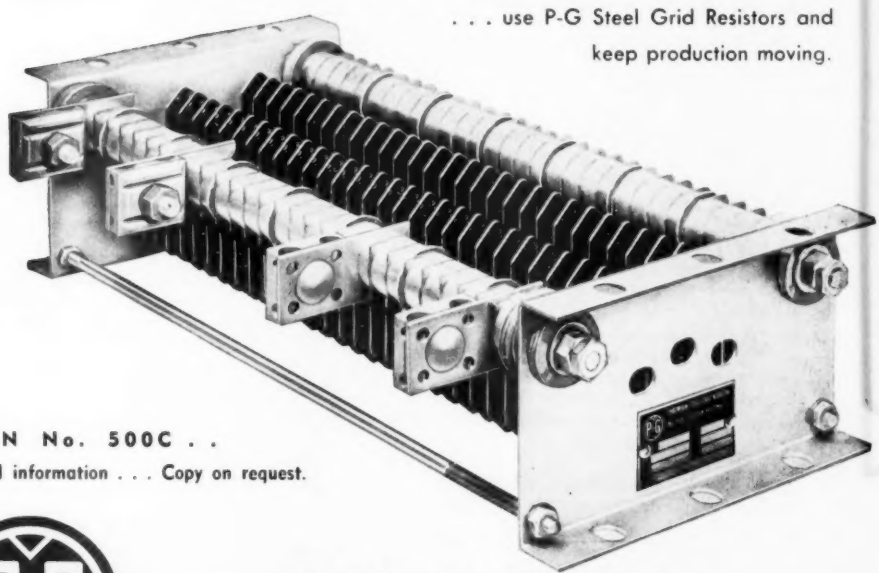
DAMAGE TO MOTORS...

DAMAGE TO CONTROLS...

COST OF NEW RESISTORS...

P-G *Steel Grid Resistors* REDUCE THIS COST...

Steel and mica construction with provision for expansion, enable P-G Resistors to withstand many factors frequently causing resistor failure. By fewer failures, P-G Resistors minimize the effect of lost machine time and expensive electrical maintenance. Be protected . . . use P-G Steel Grid Resistors and keep production moving.



BULLETIN No. 500C . .
Gives detailed information . . . Copy on request.

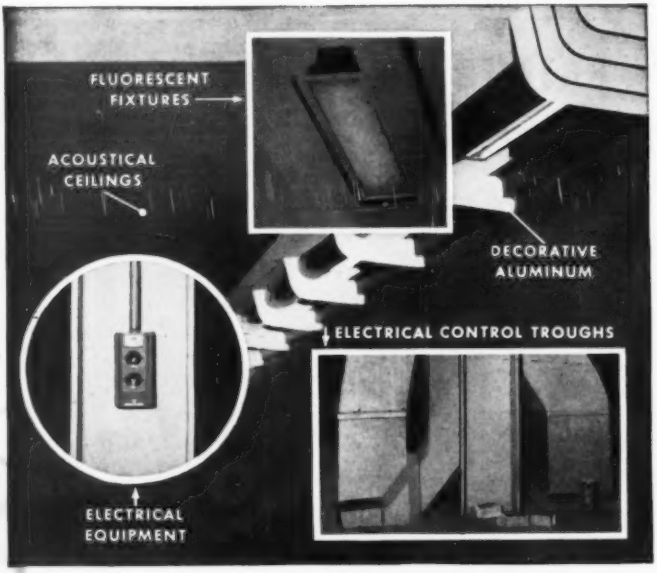
P-G

The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

• ESTABLISHED 1892 •

221 WEST THIRD STREET, CINCINNATI 2, OHIO



HOW TO SAVE MAN POWER IN INDUSTRIAL CONSTRUCTION

High-speed RAMSET® SYSTEM fastens almost anything to steel or concrete in about 1/10 the time needed by old-fashioned manual methods. For every 1000 such fastenings, RAMSET saves about 200 man-hours under ordinary conditions. This adds up to 3 important benefits:

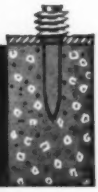
1. **Finish the building faster**
2. **Save vitally needed man power**
3. **Reduce costs in proportion**

Some of the many ways in which RAMSET SYSTEM can be applied are illustrated in Lincoln Electric Company's new plant in Cleveland, designed and built by The Austin Company. In hundreds of other buildings, leading architects and contractors are taking advantage of its high-speed, low-cost abilities.

Local RAMSET Specialists will gladly work with you to apply these 3-way economies to your projects. Send for details or refer to Sweet's Catalogs.

Ramset Fasteners, Inc.
12117 Berea Road, Cleveland 11, Ohio

MEMBER OF PRODUCERS' COUNCIL



fasten FASTER with **Ramset System** FASTENING SYSTEM
Pioneer in powder-actuated fastening

tures over long periods is desired. It is of a direct dial setting type and will maintain preselected temperature within 0.50°C sensitivity from any setting within its range. Designed to operate from standard outlet of 115 volt 60 cycle current fused to carry necessary load, it will handle loads up to 3,000 watt capacity. It is equipped with twin plug-in receptacles for hook up of devices or to solenoid or other temperature controls.

Phen-Trols Incorporated, 15 Franklin Place, Rutherford, N. J.

Adapters (31)

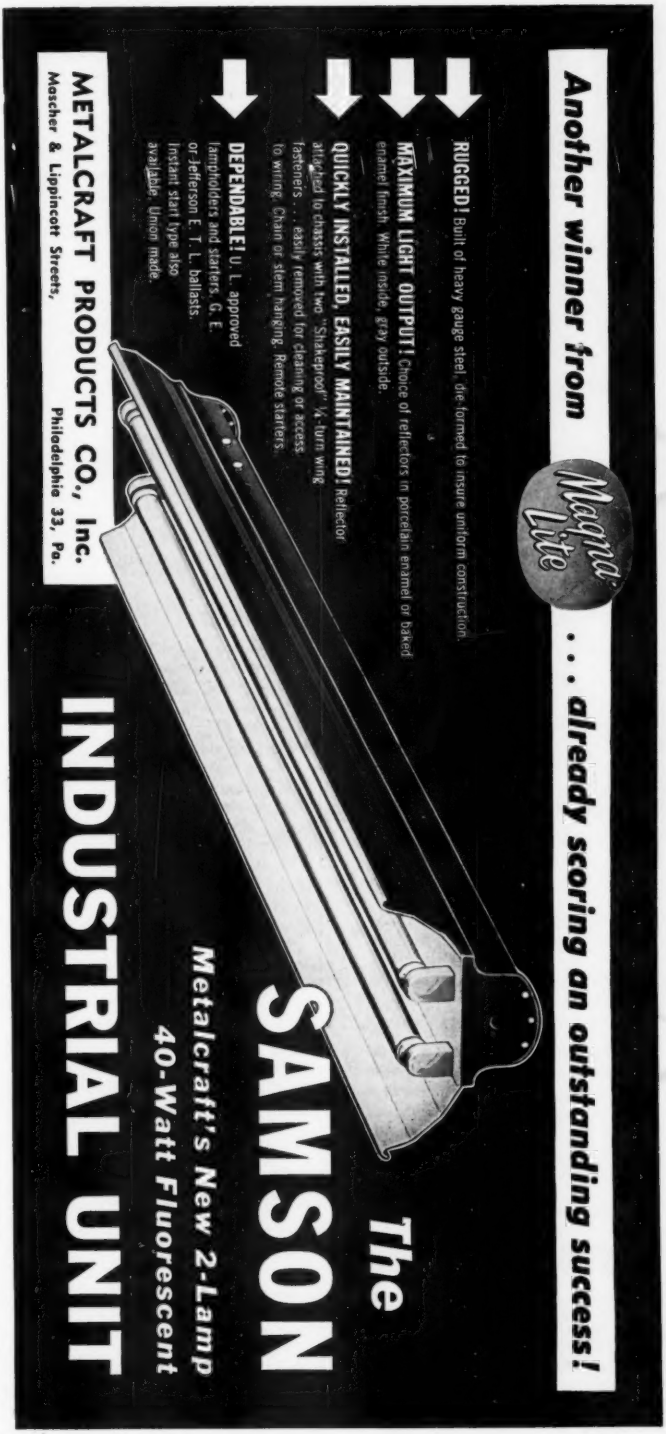
Announcement has been made of the addition of three new junction box-type cluster adapters to this line. They are: No. S-314, 4 inch round with six tapped openings and blank cover plate to mount to five Steberlites; S-315, 3¼ inch round with four tapped openings for clusters of two or three lites; and No. S-316, 4 inch round with six tapped openings plus tapped cover plate for mounting up to six lites. All units are constructed of non corrosive, cast aluminum with openings tapped ½ inch.

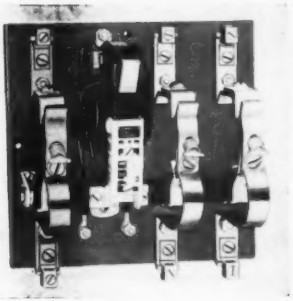
Steber Manufacturing Co., Broadview, Ill.

Lightning Arrestor (32)

A new, improved lightning arrester, designed for outdoor as well as indoor use, has been developed. It fits into TV and FM installations and is listed by Underwriters Laboratories. A plastic and metal device, it is designed to match 300-ohm transmission lines. The device uses the RCA method of attaching the arrester to the transmission lines so that it does not have to be cut or spliced. The transmission line is placed in an open slot in the plastic body, and plastic cap is screwed down firmly, causing four prongs in the device to pierce the insulation and contact the wires.

RCA Tube Department, Camden, N. J.


Another winner from
Magna Lite
. . . already scoring an outstanding success!
RUGGED! Built of heavy gauge steel, die-formed to insure uniform construction.
MAXIMUM LIGHT OUTPUT! Choice of reflectors in porcelain enamel or baked enamel finish. White inside, gray outside.
QUICKLY INSTALLED, EASILY MAINTAINED! Reflector attached to chassis with two "Shakeproof" ¼-turn wing fasteners . . . easily removed for cleaning or access to wiring. Chain or stem hanging. Remote starters.
DEPENDABLE! U. L. approved lampholders and starters, G. E. or Jefferson E. T. L. ballasts. Instant start type also available. Union made.
The SAMSON
Metalcraft's New 2-Lamp 40-Watt Fluorescent
INDUSTRIAL UNIT
METALCRAFT PRODUCTS CO., Inc.
Mascher & Lippincott Streets, Philadelphia 33, Pa.



Magnetic Switch (33)

A new line of magnetic switches, including magnetic contactors, automatic transfer switches and automatic reversing switches, is now available. They embody all the newest protective devices so that they are able to handle the rated capacities with a wide margin of safety and dependability. The reversing and transfer switches are fitted with both electrical and mechanical controls so that it is impossible to confuse the circuits. Heavy copper springs, with full floating armature, assure instant contact with rolling, wiping action on both make and break.

Lumenite Electronic Co., 407 S. Dearborn St., Chicago 5, Ill.

Waterproof Seal (34)

A moisture seal for terminating multi-conductor sheathed cables is now available. Cone-shaped to receive filling compound, the device is easily and quickly slipped over the cable. Applicable to cable diameters of from ¾ inch to 2 inches, the End Seal snugly fits over the cable sheath, preventing compound leakage. The compound hardens to form a permanent, moisture-proof seal and keeps the conductors properly spaced.

The Okonite Company, Passaic, N. J.

Regulators (35)

A redesigned line of single-phase Inductrols in standard ratings of 9.6 kva to 24 kva has been announced. They are available for single-phase circuits, 600 volts and below, up to 1,000 amperes. With standard controls, they can be used for secondary circuit regulation where lighting and power are supplied from the same lines in mills, factories and large office or apartment buildings. They can be used in laboratories and schools for controlling voltage; in calibrating and testing meters, instruments and instrument transformers; operating resistance and

DON'T LET DUST, DIRT OR WEATHER SHORTEN THE SERVICE LIFE OF YOUR MOTORS

BALDOR

Streamcooled

BALL-BEARING MOTORS

These motors are SOLIDLY ENCLOSED, cooled by an outer-mounted fan in the bell-end. They cannot inhale dust or dirt and will operate efficiently in all kinds of weather.

BALDOR Streamcooled Motors require no dismantling for cleaning. Thus *less servicing* . . . no interruption of service. Let us tell you more about these long service-life BALDOR Motors.

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induction furnaces; and running motion picture projection equipment. Inductrol consists of a shunt winding located on the rotor and a series winding located on the stator. Varying the position of the rotor with respect to the stator causes a variation of voltage in the series winding that will raise or lower the output voltage gradually, as required by changes in load.

General Electric Company, Schenectady 5, N. Y

Floodlight (36)

Announcement has been made of a new mercury vapor floodlight unit for industrial areas, filling stations, store fronts, sports arenas, parking areas, etc. The 1¼-in. slipfitter makes luminaries adaptable for pole mounting. Unit is weatherproof and rustproof, and measures 16-13/16-in. high by 12¼-in. wide. Socket is U. L. approved mogul base, multiple type. All brackets are made of 3-in. by 3-in., ¼ in. by ¼ in. angle with a standard 1¼ in. malleable iron conduit box welded into frame. Braces and brackets are rustproof aluminum finish.

Nepco Manufacturing Co., 527 South Wells Street, Chicago 7, Ill.

Regulators (37)

A new line of smaller pole- and platform-type constant-current regulators for street-lighting (type CPH) is available. Available in ratings of 5 to 30 kilowatts with 6.6 or 20 amperes secondary current, these regulators have a 2400-volt primary connection that operates on 2280 to 2520 volts. A special 2160-volt primary tap provides for operation on 2050 to 2270 volts. A new horizontal tank-type bushing allows insertion of leads from either of two directions, and a non-breakable hand-operated knob at the end of the bushing eliminates need for tools when making connections.

Westinghouse Electric Corp., Pittsburgh 30, Pa.

Product Briefs

(38) Technical Appliance Corp., Sherburne, N. Y., has announced a new non-powered **isolation box** for use with Tacoplex antenna distribution system. . . . (39) An entirely automatic, electrically-operated **ultra-violet-water sterilizer** has been announced by Sepco Corp., Pottstown, Pa.

(40) Electro-Voice, Inc., Buchanan, Mich., has introduced a new Model 3100 **TV distribution system**. . . . (41) Announcement has been made of a new break-resistant masonry **cutting blade,** known as "B-R" abrasive blade, by Clipper Manufacturing Co., Kansas City, Mo. . . . (42) A new bronze **welding rod** for "dirty" and old cast and malleable iron has been released by Eutectic Welding Alloys Corporation, Flushing, N. Y.

(43) New England Carbide Tool Company, Cambridge, Mass., has introduced a new carbide tipped masonry **drill bit** called the Cyclo-Core with removable Cyclo-Center. . . . (44) The Post Machinery Co., Beverly, Mass., in collaboration with the General Control Company, Boston, Mass., have adapted their Post promatic **electronic counters** for general-purpose counting in several variations, including total count, rate of count, and pre-determined count. . . . (45) Noma Electric Corp., New York, has announced a new **safety fuse plug** for tree lighting sets.

(46) The P. & L. Products Co., Greenville, Ohio, has introduced a new **hack saw and drill,** hand operated, electrically driven, known as the Trade Master unit. . . . (47) The Wright Safeway Army type **trolley hoist** has been added to this line by the Wright Hoist Division of American Chain & Cable Co., Inc., York, Pa. . . . (48) A **padlock** designed for the protection of boiler-cleaners, electrical repairmen and others, is offered by Corbin Cabinet Lock Division, New Britain, Conn.

(49) Photoswitch Incorporated, Cambridge, Mass., has announced a new short interval **electronic timer** for welding and other applications. . . . (50) Kepco Laboratories, Inc., Flushing, N. Y., has introduced a new 1000 volt, 500 ma regulated **power supply,** Model 1250. . . . (51) An improved electronic type 20-kw **induction heater,** featuring a nonventilated, dustproof, NEMA Type 12 enclosure, has been announced by General Electric Co., Schenectady, N. Y.

as fundamental as built-in storage space...

Eleanor Raymond, *Architect*

No electrical contract is complete unless it contains raceways for telephone wires.

Every house you wire makes some provision for storage, much of it concealed. But unless provision is made for telephones, the wires may have to be exposed. Telephone raceways keep wires out of sight, help protect the appearance of interior walls, mean extra profits for *you*. Including telephone raceways and outlet boxes in your electrical contracts is a profitable practice and good business.

BELL TELEPHONE SYSTEM

3-speed *Milwaukee* ½" drill famous for more "MOTOR GUTS"

Powerful Milwaukee HOLE-SHOOTER combines straight and right-angle drilling . . . wonder-tool for close quarters

Built for use by electrical contractors and plant maintenance electricians, this Milwaukee ½" HOLE-SHOOTER — *America's only 3-speed Right-Angle Drill* — has demonstrated its unmatched time-saving performance on thousands of jobs. Most powerful drill built for its size and 9-lb. weight. Ball and roller-bearing equipped for extra-long service life.

You'll be amazed at its versatility — unit-built for quick change to suitable speeds for drilling in wood, metal, masonry, concrete, tile. Uses wood bits up to 3" . . . also ½" carbide-tipped drills.

For straight drilling, S-412 ½" HOLE-SHOOTER (above) has a chuck speed of 450 R.P.M. *With the 2-speed "Right-Angle Drive" attachment,* speeds are 300 R.P.M. or 675 R.P.M.

Head swivels full 360°. Locks in any position.
S-412 Drill with "2-speed Right-Angle Drive" $69.00

Other bits available also — See assortment at left. We can supply you with any size wood-boring bits up to 3". Write us.

Complete S-412 Tri-Speed Kit Contains

1 — S-412 ½" HOLE-SHOOTER, Jacobs geared chuck.
2 — *Two-speed "Right-Angle Drive" attachment.
3 — 3 special bits — ¾", 1⅛", 2⅜".
4 — Special wrench.

*Pat. Pending

3 flats specially machined on shanks of these bits to fit Jacobs 3-jaw chuck.

Complete S-412 KIT.. $87.00

Call your distributor today, or write us and give his name.

MILWAUKEE ELECTRIC TOOL CORP.

Makers of portable electric drills, saws, hammers, grinders, sanders, and accessories.

3352 W. STATE STREET • MILWAUKEE 8, WIS.

CATALOGS and BULLETINS

(52) TANK CONTROLLER for multiple pump operation is discussed in bulletin 1110, including applications, installation methods and capacities of several units. Automatic Control Co.

(53) PLIER maintenance and repair, including recommendations for correcting rust, dulled edges, looseness or tightness, broken tips or bent jaws, is treated in handy booklet. Utica Drop Forge & Tool Corp.

(54) WIRING with single-piece raceways, plugmold systems or pancake overflow systems is analyzed and discussed in literature kit prepared by The Wiremold Co.

(55) FLUORESCENT fixtures with louvers, plexiglass side panels and 4-foot lamps are pictured, priced and specified in AIA file 31F2. Moe-Bridges Corp.

(56) GARAGE DOORS, electrically operated, are sketched and specified in 4-page 2-color folder. Electric Power Door Co.

(57) PORTABLE PYROMETERS for accurate spot checking of temperatures on industrial heating equipment are subject of bulletin PPY-1. Wheelco Instruments Co.

(58) PUMP MOTORS for large ac installations are discussed in series of articles presented in E-M Synchronizer 33. Electric Machinery Mfg. Co.

(59) ELECTRIC RADIANT HEAT panels for residential and commercial uses are illustrated and described in folder. Berko Electric Manufacturing Corp.

(60) FITTINGS for electrical conduit and cable, for all types of raceways, are listed in complete easy-to-find 64-page Bulletin #65. Thomas & Betts Co.

(61) CLASS H INSULATION is subject of bulletin discussing silicone varnished fiberglas, glass, mica, saturated and coated asbestos, rubber coated fiberglas and silastic tape. Irvington Varnish & Insulator Co.

(62) TWO WAY RADIO communication's contributions and potential applications in the transportation field.

RCA Victor division of Radio Corp. of America.

(63) LIGHTING DESIGN data for industrial and commercial installations is contained in multi-color bulletin LT-10 including sample color chips with reflectance factors, 68 different luminaires with typical distribution curves, height spacing ratios, maintenance factors, progressive design steps and glossary of available related IES design literature. Northern Electric Co.

(64) BUS DUCT manual B-4272A is 68-page presentation of test data, specifications, information on pricing a typical installation and typical bills of material. Westinghouse Electric Corp.

(65) TRANSFORMER information in the form of detailed drawings, ratio and phase angle curves is contained in 32-page bulletin S501-B. Standard Transformer Co.

(66) VOLTAGE REGULATORS are discussed in terms of function, operation, construction, installation and price in bulletin S351. Superior Electric Co.

(67) INSTRUMENT DATA is presented in series of perforated file sheets as follows: Safeguarding large electrical equipment in central stations (No. 9.1-7), high-speed instrument accuracy records rapidly changing variables (10.0-7), Electronik Function Plotter (10.0-5), comparison measurement of two independent variables (10.0-6), humidities for industrial air conditioning (10.5-4) and electronik strip chart potentiometer controller (175). Minneapolis Honeywell Regulator Co.

(68) SCREWDRIVER catalog-handbook is 32-page assembly of information on wide assortment of screwdriver and hand tool types. Vaco Products Co.

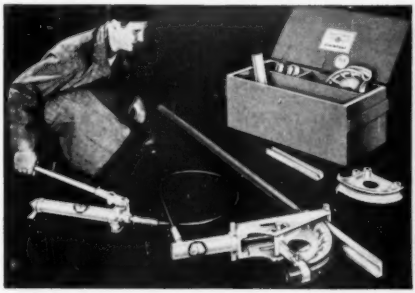
(69) ARC WELDERS for all applications are discussed with charts, specifications and recommendations. Miller Electric Manufacturing Co.

(70) CARBON BRUSHES: types, grades, characteristics, design, recommendations, maintenance and replacement suggestions. GEA-5597 is 28-page booklet. General Electric Co.

(71) OUTDOOR LIGHTING with cast aluminum fixtures and fittings holding sealed beam lamps is subject of bulletin 120-51. Steber Manufacturing Co.

(72) WORK LIGHT that is self releasing, self anchoring, self adjusting and self retracting for emergency pull-outs is discussed in bulletin 601. Pyle-National Co.

5 WAYS to slash costs on conduit installations



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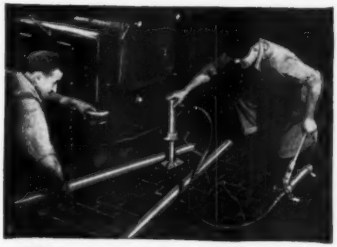

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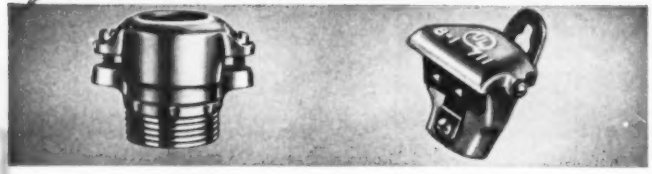

Blackhawk No. 600. Watertite Connectors for Service Entrance Cable. Smooth, non-rusting castings fitted with live rubber grommet for long time protection. Clean, easy running threads and tapered point screws for fast installation. (Pat. No. 2062400.)

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Blackhawk No. 3626. Heavy steel base and supporting strap. #22 square shoulder screw. All parts hot dip galvanized. Porcelain has compression strain only. Smooth rounded surfaces protect wire insulation. Average 45° angle pull test; 2000 lbs. REA approved.

Blackhawk No. 3627. Top quality porcelain insulator reinforced with heavy gauge steel yoke and held together with solid steel pin. Porcelain has compression strain only. #22 sharp point screw has square shoulder swaged to harness and cannot slip. Harness is hot dip galvanized. Average vertical pull test 2250 lbs. Average 45° angle pull test 1875 lbs.

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(73) WELDING ALLOY (low temperature) specification chart contains complete data on close to 100 different alloys used in welding, brazing and hard surfacing. Chart 246P. Eutectic Welding Alloys Corp.

(74) STORAGE BATTERY, light, small and rechargeable, is subject of technical brochure 1. Yardney Electric Corp.

(75) PLASTIC-ARMORED E.M.T. to resist the action of fumes, gasses, steam and other corrosive materials is subject of file folder. Republic Steel Corp.

(76) GLASS in the design of electrical products is subject of bulletin B88 containing application examples, properties and electrical characteristics. Corning Glass Works.

(77) STARTING SWITCH for manual operation of ac and dc motors is discussed in 8-page bulletin 600. Allen-Bradley Co.

(78) DRAFTING TABLE, steel, adjustable, with or without drawer, is dimensioned and priced in bulletin 202. Stacor Equipment Corp.

(79) FOOT SWITCH for control of sound and transmission equipment, relays, solenoids, magnetic switches and business machines is discussed on file sheet with specifications and prices. Simonds Machine Co.

(80) MOTORS, single-phase, polyphase and squirrel-cage, including units from 1/20th to 400-hp, are pictured, specified and described in 4-page folder. Wagner Electric Corp.

(81) EXPLOSION-PROOF BELLS for hazardous locations are discussed, specified and sketched in bulletin EPI. Signal Engineering and Mfg. Co.

(82) LIGHTING GUIDE to better drafting is discussed in form LS-137, with drawings to illustrate proper positioning of drafting boards, recommended types of lighting systems. General Electric Co.

(83) SERVICE MASTS for low-roofed houses are presented with detailed drawings, notes and prices, in bulletin 55. Electrical Manufacturing Co.

(84) LADDERS of all-steel construction with safety treads and rolling casters is subject of 6-page 2-color file folder. Ballymore Co.

(85) FITTINGS for electrical trade are priced and specified in compact, cross-referenced manual. O. Z. Electrical Manufacturing Co., Inc.

This high-intensity installation of surface-mounted SKYLIKE units was selected for the modernization of the Amesbury, Massachusetts, Public Library. Note the low brightness levels even at the light source . . . the effectiveness of the 90° shielding . . . the absence of harsh shadows and sharp light cut-off lines.

A patterned group of recessed units in the dining room of the Bader Hotel in Spring Valley, N. Y. illustrates the way Silvray SKYLIKE fixtures fit 24" x 24" ceiling tiles. Note how the soft, even distribution of low-intensity light helps to create the desired mood of cheerful hospitality.

SKYLIKE® Lighting— "installation-proved"

IN SCHOOLS, OFFICES, STORES, AND PUBLIC BUILDINGS

Blending the soft, indirect light of silvered-bowl incandescent lamps with the modern look of fluorescent-type troffers, Silvray SKYLIKE units permit an almost unlimited variety of exciting new lighting applications.

As recessed, surface-mounted, or suspended units . . . in patterned groups or panels . . . for new construction or modernization you're sure to like the versatility, efficiency, and low cost of SKYLIKE fixtures.

Look at these typical installations!

(Unretouched photographs, using room light *only*, demonstrate the unusually uniform distribution of light provided by SKYLIKE fixtures.)

Architect Harvey P. Clarkson of Petroff and Clarkson, New York, N. Y. specified this suspended Silvray SKYLIKE installation for the conference room jointly used by the Tea Association and the Tea Bureau, Inc., at 500 5th Ave. Providing a medium lighting intensity of approximately 35 foot-candles, these SKYLIKE units represent an initial investment saving of from ⅓ to ¼ the cost of competitive equipment offering comparable results. The lighter weight and internal simplicity of the fixtures also permits additional savings in installation time.

SKYLIKE fixtures assure adequate, comfortable illumination for employees of the Stewart Company in its Dallas, Texas, offices. The Stewart Company, a well-known distributor of Ford tractor and Dearborn farm equipment, also benefits from the unique construction of SKYLIKE units — construction that permits floor-level relamping with pole-type lamp changers . . . quick changes in light-distribution characteristics . . . and variable light output through interchangeability of 150- to 500-watt lamps.

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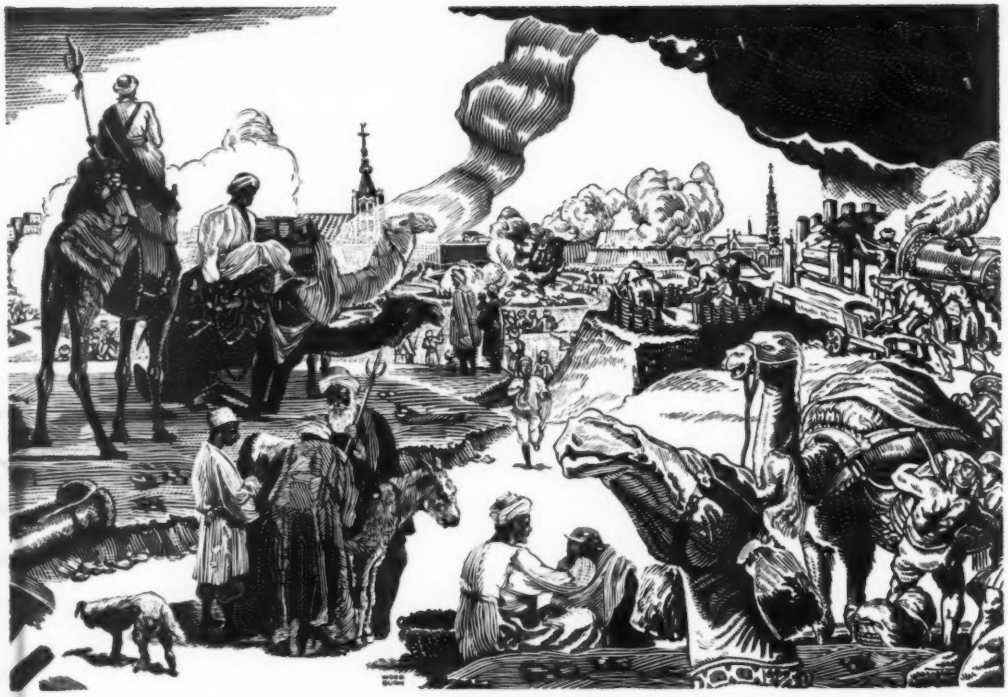
Send for complete SKYLIKE information. A comprehensive booklet describing the SKYLIKE system is yours for the asking. To get your copy, write Graybar Electric Company, Inc., Graybar Building, 420 Lexington Avenue, New York 17, N. Y.

S110-48

SILVRAY LIGHTING INC.



Steel saved civilization at Vienna

MODERN history begins with the record of conflict between Christians and Moslems--six centuries of wars that opened with the Crusades and saw the Turks capture Constantinople in 1453.

More than 100,000 Turkish janizaries and cavalry besieged Vienna in 1683. For two months, to quote the diary of an eye witness, "The enemy continued playing their cannon and granadoes. But the city walls were strong, Christian cannon were bigger and more numerous and ammunition more plentiful." Finally came a day when the officer's journal reported, "The enemy did not play their cannon so fast. It was confirmed that they had no great provision of bullets, inasmuch as they shot back not only our bullets, but also pummels of swords and all sorts of iron and stones."

At last a great Christian relief army was assembled. "They made an attack in the best order that ever army did. The enemy, forced always to give back, were put all into confusion. They betook themselves to flight, leaving all their provisions, ammunition, cannons and tents --the greatest part rendered unfit for farther use by our great guns."

Never again did the Turks seriously menace Christendom. Western civilization had been saved once more by its supremacy in the use of iron and steel. To aid our survival America's free private industry is producing steel at the highest rate ever known--and still expanding. The question remains--Will America use enough of this tremendous steel production to guarantee the continued supremacy of Western, Christian civilization?---We believe the answer is yes!

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QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Reader's Quiz

Fluorescent Lighting

QUESTION M-18—*Can a two lamp 60 watt fluorescent fixture operate normally with the starters in series with both of the tubes? Ordinarily, each starter is in series with its respective lamp.*—E. H.

ANSWER TO M-18—The starters are in series with the lamp filaments, it is true, but they are parallel to the gaseous arc which is struck when the tube lights. As the switch is thrown, the current path is through the tube filaments, the starter, and the ballast in series. As the starter heats, it opens up and the gas inside the tube, which is parallel with the starter, substitutes as a current path. Since the two tubes must be in parallel across-the-line, in order to get rated voltage, it would be impossible to put the two starters in series any place in the circuit and still have both of the lamps light.—H. S.

ANSWER TO M-18—Of course, the answer to E. H.'s question is—no. With the starters in series, whichever starter operated first (opened) would probably cause the two 60 watt lamps to light, if the striking voltage was sufficently high. *But*, the load being broken by the starter would be about double the normal rating of the starter. Such operation would lower the starter life, could cause sticking of contact points, could cause burning of contact points, or might easily cause a burnout of ballast.—W. B. M.

Capacitors

QUESTION N-18—*Why does a motor start better with a capacitor in circuit? I understand that it acts almost as a 2 phase machine. If this is correct, why?*—J. J. B.

ANSWER TO N-18—A capacitor start motor develops approximately 300% full load torque from zero to 75% of synchronous speed, while the standard split phase motor has a torque from 150% full torque at zero speed to 250% torque at 75% synchronous speed. With these higher torque characteristics, a capacitor motor will bring an equal load up to speed in less time than an ordinary split phase motor, hence, a reduction in starting effort (i.e. starting current).

The capacitor motor and a two phase motor do have very similar torque vs. synchronous speed characteristics; and this is due to the fact that, while starting, the capacitor motor more nearly approaches a two phase motor than any other type single phase motor.

The phase angle between the current in the starting winding and the running winding can approximate 90 degrees. This is caused by the starting winding taking a "leading" current and the running winding taking a "lagging" current, the vector difference between these two currents is very similar to the phase currents in a two phase machine.—M. C. R.

ANSWER TO N-18—A capacitor-start motor is a form of split-phase motor having a capacitor connected in series with the auxiliary winding. The auxiliary circuit is opened when the motor (rotor) has attained a predetermined speed.

Like the split-phase motor, the capacitor-start motor generally resembles the two-phase motor in that there are two stator windings, displaced 90 electrical degrees. In order to obtain the rotating field necessary to develop starting torque, it is necessary that the currents in these two windings be displaced in *time* phase. In the case of the polyphase motor, this phase displacement is obtained by connecting the two electrically similar windings to two voltages differing in phase. In both the split-phase and capacitor-start motors, the two circuits are connected to the same voltage; and the phase displacement of current is obtained by a dissimilarity of the electrical constants of the two circuits.

Another explanation for the greater effectiveness of starting is the fact that the flux condition in a capacitor-start motor at standstill is similar to the flux conditions of a two-phase motor.

In a capacitor-start motor, the capacitor causes the auxiliary-phase current to *lead* the main-phase voltage, obtaining a large angle of displacement between the currents in the two windings. The line current of this motor is only two-thirds the line current of the corresponding split-phase motor; yet this motor develops more than twice the starting torque of the split-phase motor.

Both types of motors have electrically distinct windings, generally located 90 electrical degrees apart.

There are, therefore, two electrical circuits or phases. The main phase consists of only the main winding connected across the line. The auxiliary, or capacitor, phase comprises an auxiliary winding, a capacitor, and a centrifugal switch which opens at approximately 75 to 80% of synchronous speed; all three are connected in series. —O. C.

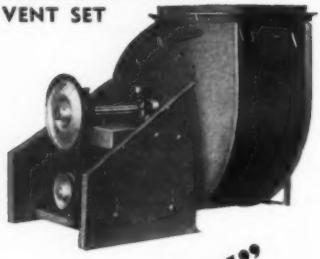
ANSWER TO N-18—A single-phase motor with a single winding, only, has no torque at standstill. Given an impulse in either direction, it will run in that direction. The reason is due to the fact that a single phase winding produces only an *alternating* magnetic field. However, when the rotor bars move to cut this alternating magnetic field, currents are induced which set up a resultant *rotating* magnetic field which produces a resultant torque. This torque increases to a maximum as the speed increases to approximately 75% of synchronous speed.

The function of the *capacitor* is to cause a current to flow in the starting winding susbtantially 90 degrees out of phase with the running winding current. These two produce a 2-phase rotating magnetic field which gives the motor an initial starting torque and rotation. After the motor gets up to about 75% of normal speed, a centrifugal switch disconnects the starting winding and capacitor. There are other ways to produce a 2-phase rotating field from a single-phase source but the capacitor method is the best.

It is evident, therefore, that it is not a case of "a motor starts better with a capacitor in circuit." A motor designed for capacitor starting just does not start unless the capacitor *is* in the circuit.—E. A. H.

ANSWER TO N-18—Capacitors are used in the starting winding circuits of one phase motors to displace the current in that winding from that of the running winding. This gives it a starting characteristic similar to a two phase motor. The amount of displacement depends on the manufacturer's design of the motor; that is the amount of capacitance and the amount of current the winding is designed to draw. —T. L. T.

BUFFALO BELTED VENT SET



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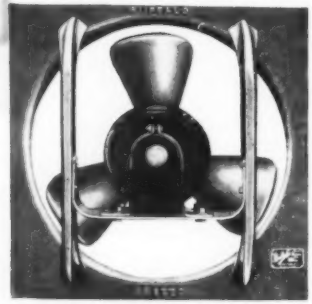

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Grounding

QUESTION P-18—*In our switchyard, there are several gang operated three phase 66 kv. airbreak switches that are used to interrupt the charging current of 5000 kva. transformers. These have conventional operating levers located at ground level on the steel structure. I have been told that a metal ground plate should be provided for the operator to stand on when opening these switches. Why is this necessary, and if it is, wouldn't an insulated platform be more suitable?*—W. P. R.

ANSWER TO P-18—W. P. R. has brought up an interesting question on the whyfor of grounding the switch operator's body as he manipulates the airbreak switches out in the switchyard. Controversial subjects, there are plenty in the electrical . field; and neither opponents nor proponents are wholly wrong because of their opinions on a given subject. Grounding, and in this case the grounding of the person, has long been the cause for heated debate, in classroom and industry.

Permit me to venture a guess that most of the graybeards who came up with the development of the electrical industry will go along with the idea of furnishing the switchman a well grounded plate to stand on as he operates his switches. Count me among those that believe he should have the final flourish of the safety engineer's solicitous care. I have helped carry a buddy from a switch yard and thence to his grave. The accident left an indelible impression on my memories.

Grounding systems are provided at electrical stations for two main purposes: (1) Safety to operating personnel and to the public; and (2) to provide ample, low resistance paths to earth for transformers and other power equipment neutrals. No rigid, inflexible rules can be laid down or enforced in planning or installing ground facilities. Like medicine that won't work for all patients, a system is tailor-made for one station and fully ineffective for still another.

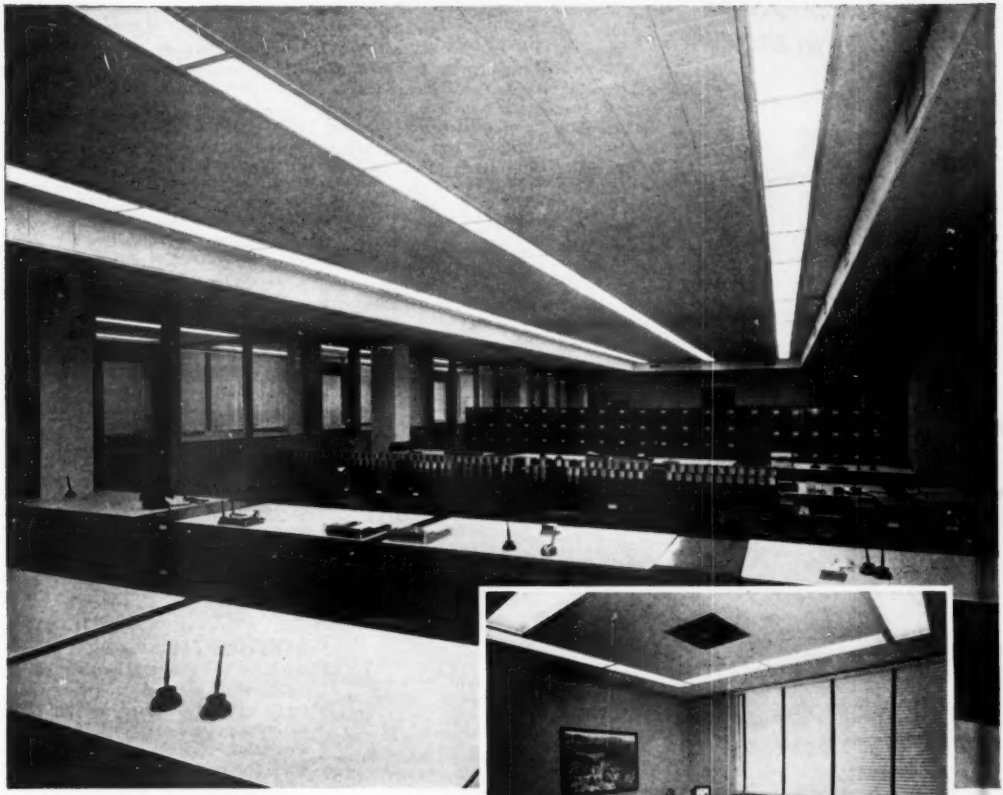
Essentially, one strives to achieve a goal where every switch frame, transformer tank, metal tower, conduit run and cable sheath, plus metal fence, switch linkage and operator platform are all tied to an effective ground by its own individual lead wire. To insure having all the station connections equalized, the various leads are then tied to heavy ground cables and thence to earth. One does this to be sure that no one will furnish his body as conducting medium to or from earth for electrical currents that are in an awful hurry to go places. In this day of ultra high transmission voltages, and old man lightning not to be forgotten either, the switchman is only safe when he is part of the apparatus he is manipulating. He does just that when he stands on a plate that is assuredly PART of the well built ground system. —P. C. Z.

ANSWER TO P-18—If the plate is thoroughly grounded, and the operating lever is well bonded to the plate, then there can be no difference of potential between the two, and an operator would be perfectly safe.

An insulated platform would help, but there could still be certain hazards. In a pouring rain, there could be some leakage between your body and ground; also there is a chance that some tool or a piece of pipe could be resting against the platform and the ground at the same time. Any article of this type could act as a shunt around the large insulators used to support the insulated platform. Even grass or vines, etc., can grow up onto the platform above the insulators and perhaps cause an accident.—M. C. T.

ANSWER TO P-18—A shock is due to a voltage between parts of the body, depending upon the value of current flowing in the ground and the resistance in the path of the current. If the resistance is high, as in dry soil, the difference say between the feet of the operator may have an appreciable difference in voltage potential even resulting in a fatal shock. With a metal conducting surface, the voltage difference may be reduced to a negligible value not even felt by the operator. Animals, particularly horses and cows, are easily shocked due not only to their greater sensitivity, but to the greater distance from the fore to the hind feet, resulting in a greater voltage difference between these points of contact with the ground.

There have been many partial methods used for reducing the likelihood of shock to an operator by adding, in addition to thorough grounding to provide minimum resistance to ground, a metal conducting area preferably of copper mesh or screening directly below the ground where the operator stands when operating the switch. Calculations and even actual tests have been made to determine ground potentials existing during the fault periods, and based on the data, the necessary steps can be taken and means provided for reducing and virtually eliminating any operating hazard. There is on record a fatality due to a station insulation breakdown when a nearby worker ran and due to the greater span between points of earth, in this instance his feet, resulting in a fatal shock.



This

LIGHTING WORKS TO MAKE WORK

LIGHT

JOB: Speed Industries, Inc., New Office Building, Louisville, Kentucky.
ARCHITECT: Nevin & Morgan, Louisville.
ENGINEER: E. R. Ronald & Associates, Louisville.
ELECTRICAL CONTRACTOR: Henderson Electric Company, Louisville.
FIXTURES: No. 5124 and No. 5128, 2-lamp slimline fixtures with hinged doors, modified to accommodate No. 9015 Holophane Low Brightness Lenses.
INTENSITY: Small private office, 70 footcandles, initial average on desk top. Main office, average readings at desk top level, 55 footcandles initially.

Lighting fixtures by LITECONTROL prove the value of up-to-date, glareless office illumination. For, as so many are learning, better light not only means better sight — it means also faster work, fewer errors, and fresher, clearer-thinking, "on-the-ball" workers.

For easy, speedy servicing or relamping of the fixtures in this installation, the hinged frames of each unit are opened by simply loosening the self-retaining catches. If desired, the frames may be removed from the housing by hand.

Day by day, more and more owners, architects and contractors are "turning the switch" to LITECONTROL . . . the lighting that works to make work light. Next time, *you* try it . . . *and see!*

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Better 3 Ways!

1. IT'S SIMPLE

One-handed operation. Load—position—fire. Stud imbedded—job done. Two basic parts—barrel and firing unit—easy to service. Integral cartridge bans matching and fitting—ready to use.

2. IT'S VERSATILE

Drives studs easily into steel or concrete. Interchangeable barrels permit driving of either ¼ or ⅜-in. studs from same firing unit. Wide range of studs available—solid head, internal or external threaded types.

3. IT'S SAFE

Center-fire cartridges plus spring-loaded safety arm that must be rotated 180 degrees and held before stud can be fired makes accidental discharge impossible. Barrel design and long bearing area of piston avoids ricochet, flash, recoil. Cartridge assemblies assure right load for the job. Write for Bulletin No. TA-17.

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Big, profitable sales opportunity in a broad market with this time, labor and money saving tool for maintenance, repair and construction work. Cartridge-studs bring repeat business. Act now!

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The use of insulated platforms was more common in the past and was effective for the lower voltage ranges, 66,000 volts and less, but lack of suitable maintenance, cleanliness of insulation, etc., resulted in troubles. Also, the necessity for stepping off the ground to a platform and the possibility of accidentally stepping off the platform resulted in injuries.

To summarize, if the entire substation ground or area visited by operators was completely covered with a continuous metal covering of sufficient conductivity to make practically impossible the existence of a dangerous voltage difference; which might affect a person due to any anticipated fault, the situation would be satisfactory; and the elimination of obstructions like platforms would be most desirable.—C. O. D.

Can you ANSWER these QUESTIONS?

QUESTION V18—A rural distribution line of 6600 volts, with one side grounded to earth, at every fifth pole, has a heavy "surge" current when first energized.

It is supplied by 50 amp fuses, and they will blow when energized, unless the men go some distance below and disconnect some of the "spur" lines first.

The load is not heavy, and evidently no trouble on it. There are probably 110 customers supplied by the 50 amp fuses.

Is it possible there can be enough "capacity" to do this with the grounded system, when the load is all connected at once? The earth is acting as one plate of a condenser, and it is hilly country with considerable ledge and mineral.—M.C.T.

QUESTION W18—Recently, we were called to service a medium sized refrigeration installation. After completing our necessary repairs, as a matter of course, we made an ammeter check of the 3 phase, 220 volt, 3 hp. motor. The current in two of the phases was 8.9 amps., but in the third phase only 4 amps were being drawn. An immediate voltage check was made between the phases, and all potentials were equal within a very small percentage, which led us to believe that a defect existed within the motor. Before opening the motor for tests, we checked a second, similar installation, fed from the same feeders and found exactly the same conditions. We then checked four or five other 3 phase motors of various sizes and found in every instance two phases drawing normal current and the third approximately half normal. In no case was there any sign of overloading or heating, and all motors started easily with full torque produced.

Is there some fault which could exist in the supply system which could cause this condition, and how can this be checked and cured, or does it cause no harm?—G.L.R.

QUESTION X18—Which is the best way to test fluorescent starters FS-2 and FS-4? I am also interested in knowing how others can be tested.—F. D.

QUESTION Y18—We have a 250 volt 200 ampere shunt wound direct connected exciter that runs at 3600 rpm. Recently, we were alarmed when the machine began to spark violently on two brushholder arms of like polarity. It was found that the sparking could be stopped by tipping any one brush of the two sets slightly in its holder. As suddenly as it started, the sparking ceased. Could anyone suggest a reason for this sparking?—W. P. R.

QUESTION Z18—We have an auto call system (paging with lighting code) which consists of many thousands of feet of wire feeding eight different buildings spaced about 2000 feet apart, roughly, which is fed by impulses (motor driven selector switch sends the proper number of impulses) from a 110 volt ac system with bare neutral. These pulses which are sent to the various buildings operate relay mercury switches which in turn operate the paging lamps within the buildings, picking up the voltages for the lamps from a circuit within the building. These pulses, which are sent out from a central building, travel underground and overhead on poles; and when a ground takes place on the hot leg of the impulse feeder, it becomes rather hard to find as we always have the normally grounded neutral, to which the relay coils are connected, to contend with. The feeders are No. 6 A.W.G. wire size.

Could someone suggest a good method of localizing a ground on this system because a ground on the hot leg (does not have to be a solid ground) will prevent the pulses from operating the relay coils. There are 9 relay coils connected to this wiring with about 45 ohms per coil. Coils are connected from one side of line to bare neutral wire.—E.J.K.

PLEASE SEND IN YOUR ANSWER BY SEPTEMBER 15

HERE'S PROOF

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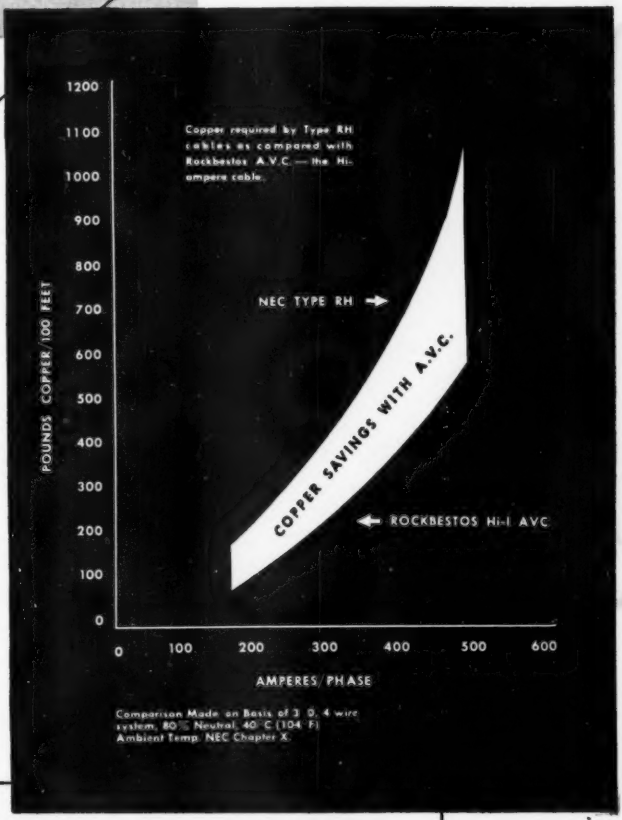

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and

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GLENN ROWELL
Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

and

B. A. McDONALD
Chief Inspector
New York Board of Fire Underwriters
Rochester, N. Y.

Questions on the Code

Acoustical Ceiling

Q. *Recently in our town, quite a controversy has developed concerning the application of an acoustical ceiling in an existing building which had originally been wired in an approved manner. In applying this acoustical ceiling to a concrete poured slab, the combustible material was extended between the canopy of the electric lighting fixtures and the ceiling slab. Is this not a violation of the Code?*—E.N.R.

A. Yes. The National Electrical Code provides, under Section 4124, that any combustible wall or ceiling finish exposed between the edge of a canopy fixture or pan and an outlet box shall be covered with noncombustible material. If the fixtures in question were of the surface type, the hazard might be quite severe. If, on the other hand, the fixtures are of the pendant type with all joints well soldered and taped or connected by approved type connectors, we believe the hazard might be rather negligible, even though it is still a violation of the Code requirements. Where a combustible acoustical ceiling treatment is applied to a ceiling which is itself of combustible construction, then we believe the use of a metal plate should be required to cover the combustible material covered by the canopy as the hazard created is much more severe. —G.R.

Outlet Boxes For Switches

Q. *Is there any Code provision which prohibits the use of switch and receptacle boxes as outlets for sidewall fixtures?*—D. McB.

A. Section 3719 of the Code covers the requirements for boxes used as outlets for fixtures. This rule requires the box to be designed or so installed that a fixture may be attached. This requirement leaves a question which concerns the design of an ordinary switch or receptacle box meeting this requirement for a fixture attachment. Since most fixtures used with such boxes are provided with fixture straps or studs that properly attach the fixture to the box and since most boxes are designed for such attachments, it appears that the Code is satisfied. A recent official Code interpretation appears to support this contention. This interpretation, No. 367, issued 12/26/50, answers the question as follows: "Yes, when properly supported within the wall or partition in which it is mounted and when suitable means for supporting the fixture within the boxes are provided".—B. A. McD.

Grounding Conductor

Q. *During the reinspection of a number of R.E.A. connected farms I have noted that in many instances the cream separator frames are grounded by means of a grounding conductor run to a nearby ground electrode. After a little investigation, I found that one of the largest producers of this type of equipment was supplying with their installation instructions a diagram indicating that their separator should be grounded by means of a special ground electrode driven as close as practicable to the separator. Would it not be preferable to carry the grounding conductor back to the service equipment and connect it to the neutral terminal bar?*—B. T. F.

A. Section 2551 of the Code states that the path to ground from circuits, equipment, or conductor enclosures shall be permanent and continuous and shall have ample carrying capacity to conduct safely any currents liable to be imposed on it, and shall have impedance sufficiently low to limit the potential above ground, and to facilitate the operation of the overcurrent devices in the circuit.

Then, under Section 2554, we also find that where the alternating-current system is connected to a grounding electrode in or at a building as specified in Sections 2523 and 2524, the same electrode shall be used to ground wire enclosures and equipment in or on that building.

Therefore, the use of a separate ground electrode for the grounding of the frame of a cream separator is definitely a violation of the National Electrical Code. Furthermore, inasmuch as the resistance to earth of this special ground electrode is an unknown quantity, its use simply leads to a sense of false security on the part of the user of the equipment. If, for instance, the resistance on a ground rod that this device is grounded to were as low as 20 ohms, it would still comply with the Code requirement for having a resistance of less than 25 ohms and yet only 11½ amperes of current would flow. If the motor operated at 230 volts and was directly shorted to the grounding rod or if only a 115 volt motor were involved, only 5¾ amperes would flow and in either case such a short could not open a 15 ampere overcurrent protective device. Often it is impossible to obtain resistances as low as 20 ohms with a single driven ground rod especially in sandy soils or in areas where rainfall is not too plentiful. On the other hand, if the device is grounded to the neutral terminal in the service entrance equipment, we not only have the neutral ground at the service but also the neutral grounds back on the primary system of the power utility supplying energy, and often these combined grounds will have a resistance to earth of not much more than one or two ohms. Due to this fact it is most essential that you recommend the devices be grounded to the neutral terminal in the service equipment.—G. R.

1951 Code On Garages

Q. *The garage in question has a stairwell leading down to a basement from the floor area where school busses will be stored. Electrical equipment must be located 4 feet above floor level where busses are stored, or if below this level explosion-proof fittings are to be installed. This is my question: What type of wiring should be installed in stairwell and basement below floor where busses are stored? I am of the opinion that this stairwell and basement might become a hazardous location if any gasoline fumes were present on the main floor where busses are stored. Please correct me if I am wrong, but wouldn't the gas fumes tend to hang to the floor level*

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North Adams, Mass.

and eventually find the stairwell and follow down to basement?—D.L.B.

A. In reply to your question, regards the school bus garage, I wish to advise that the definition of a garage (under definitions) includes any floor beneath the garage, which is not cut off by a suitable cut off. Since there is an open stairwell in the garage, this eliminates the question of a suitable cut off.

Section 5102 of the 1951 Code has a new provision reading as follows: "Where reference is made in this article to a level of 4 feet above the floor, it shall be construed to mean each floor at or above grade level. In the case of floors below grade level, the measurement shall begin, not at the floor, but at the bottom of outside doors or other openings at or above grade level."

It appears to me that the correct interpretation of the last sentence of this new rule would place the entire basement in a position where all the rules, which apply to 4 feet above the floor, must be enforced. In other words all of the rules covering garages which apply to within 4 feet of the floor would apply to the entire basement if it was 8 feet or 10 feet high.

Gasoline is heavier than air and you are correct in assuming any gasoline fumes on first floor would follow the stair opening to the basement.—B.A.McD.

Size of Service Conductors

Q. *For some time there has been some discussion in this city concerning the size of service conductors which must be used where the size of the service switch is greater than the actual connected load. As an illustration, we are now installing wiring in a building where the total connected load will be approximately 140 amperes and therefore are using a 200 ampere rated switch. Now, must we utilize service entrance conductors capable of supplying 200 amps?*—M. H.

A. Section 2304 of the National Electrical Code governs the size of service entrance conductors which shall be used, and you will note this section states the service entrance conductors shall have adequate current carrying capacity to safely conduct the current for the load supplied without a temperature rise detrimental to the insulation covering the conductors. Therefore, the total connected load minus whatever demand factor may apply as is determined by the table contained under Section 2203 will determine the size of the service entrance conductors. It is, of course, possible that no demand factor may apply to the lighting load, and, inasmuch as you did not describe the type of occupancy in the building in question, I thought it advisable to call your attention to the possibility of a demand factor applying. It is, I believe, also advisable at each installation to consider the possibility of future growth, and, in most instances, compliance with the Code minimum requirements is economically unwise if there is any unlikelihood of additional loads being required within a relatively short time.—G. R.

Flexible Conduit Used Outdoors

Q. *Section 3502 of the Code says that flexible conduit may be used in a wet location when the conductors used are lead covered or other type specially approved for the purpose. What types are specially approved for this use, and does this rule permit the use of flexible conduit outdoors when such conductors are used?—M.S.*

A. It is my opinion that either types TW or RW are considered as suitable for use with flexible conduit which is used in wet locations. I also believe that flexible conduit might be used outdoors if the conductors used are either lead covered, Type RW or type TW.—*B.A.McD.*

Motor Installation

Q. *Some time ago we installed a three phase motor and provided it with two thermal cutouts on two of the phase conductors as was required by the Code. During a recent storm, one of the utility company's phases was interrupted, and shortly thereafter we were advised by our former customer that this motor showed signs of serious heating, so it had been disconnected from the service. In discussing this with electricians and the inspector, we were advised we should have had three units, one in each phase wire for proper thermal protection of this motor, and inasmuch as we had originally complied with the Code, we are wondering why the Code did not mention such protection as being necessary if a motor could overheat under such conditions.*—R. C. G.

A. It is true that your installation was in compliance with the 1947 edition of the National Electrical

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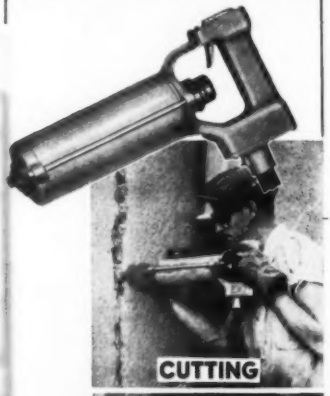

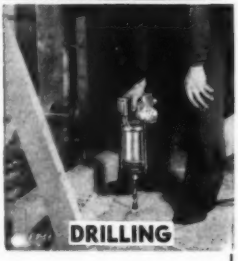

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Code. However, the 1950 supplement to that code did contain a recommendation to cover just such a situation as you have encountered. The present 1951 National Electrical Code contains this same recommendation. That is for some type of an overcurrent unit (such as a trip coil, relay or thermal cutout) in each of the conductors to a three phase motor when those conductors are supplied from the utility distribution system through either a Wye-delta or a Delta-wye connected transformer provided the authority enforcing the Code realizes that in his respective territory there is the possibility of a motor winding failure where only two of the phase conductors are so protected whenever a single phase might fail on the primary. Therefore, in any area where it is common practice to ground one of the phases, overcurrent units should be used in each phase conductor supplying all of the three phase motors obtaining energy from the same primary system. —G.R.

Non-Metallic Sheathed Cable Installation

Q. *I am told it is permissable to run Romex (non-metallic sheathed cable) under floors, stapled to sills, of one story building from outlet to outlet. Please give your opinion. —H.F.G.*

A. It appears to me that this procedure would satisfy the requirements of Section 3364 of the Code, which covers general requirements for the installation of exposed non-metallic sheathed cable. I am assuming that the cable closely follows the surface of the sill and is protected from mechanical injury where necessary.—*B.A.McD.*

Concrete Blocks

Q. *Is it true that the new Code will now permit the use of concrete blocks for the erection of a transformer vault?*—N. L. L.

A. Yes. Under Section 4542, provision is now made in the National Electrical Code to accept the use of 12-inch load bearing hollow tile or 12-inch load bearing hollow concrete building units, provided the inside surface of such tile or concrete block walls are given a coating of cement or gypsum plaster not less than ¾ of an inch in thickness. It is, of course, assumed that the concrete blocks used for such vault construction will have been manufactured in accordance with the standards as prescribed by either the Underwriters' Laboratories, Incorporated, or the Portland Cement Association.—G. R.

T and TW Conductors

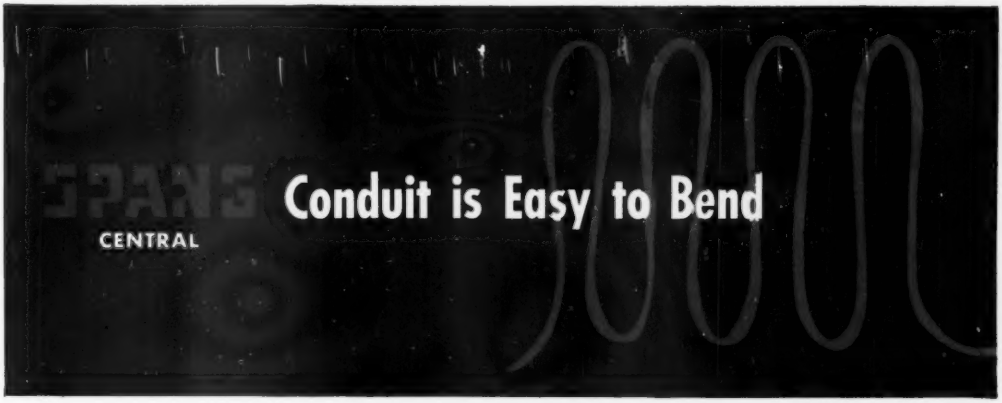
Q. *For several years, I understood the N. E. Code to prohibit the use of Type T or TW conductors, when used in raceways, to be larger than No. 0000. Recently, however, one of my competitors installed a conduit service with 3-500,000 c.m, Type T conductors. Has this rule been changed?—A.L.B.*

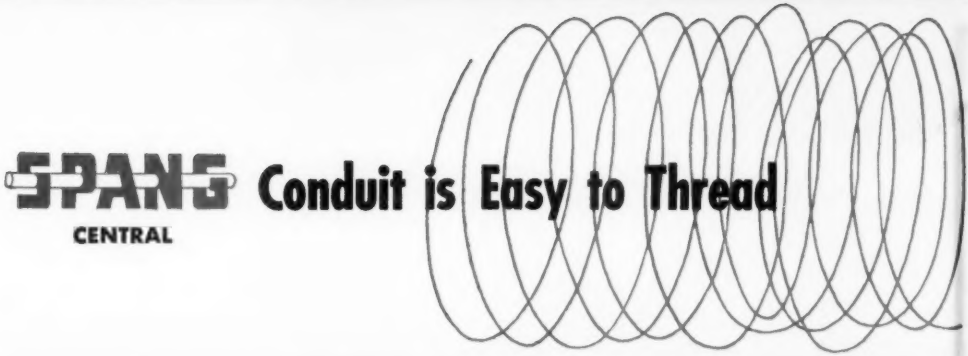
A. According to the 1949 Code, Table under Section 3102, both type T and TW conductors were limited as to use as follows: "No. 14 to No. 0000 inclusive. Open work No. 14 to 2,000,000 C. M." According to the 1951 Code, same Table Section 3102, this provision has been eliminated. As a result Types T and TW conductors have the same Code recognition as Type R conductors, and they may be used in raceways such as conduit with no restriction on the size of the conductor. It is also interesting to note that the new Table now includes the new Type RUW conductor for general use in wet locations.—B.A.McD.

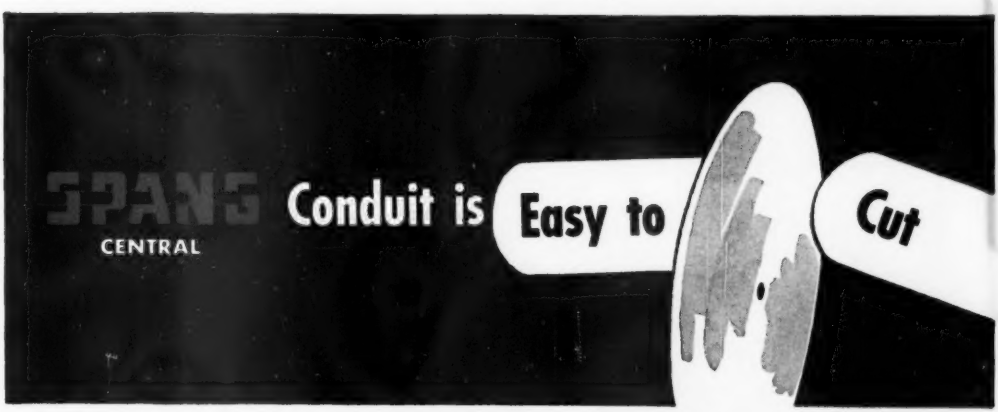
Motor Control

Q. *Our attention has been called to Section 4343 of the Code, which concerns the use of special types of motor controllers where two or more motors are used to operate a single machine. How does one determine whether or not the motor controller is suitable for this special application as is required by this section?*—J. M. A.

A. Motor controllers designed for group installation, or the control of two or more motors on a single machine or operation, must contain thermo overload relays capable of withstanding short circuits which would result within the maximum rating of the overcurrent protective device protecting the circuit supplying all controllers in that group. Therefore, a magnetically operated controller designed for group installation must be capable of operating under the maximum overcurrent protective device permitted for the circuit supplying the group and the name plate on such a controller should indicate what that maximum protection may be.—G. R.







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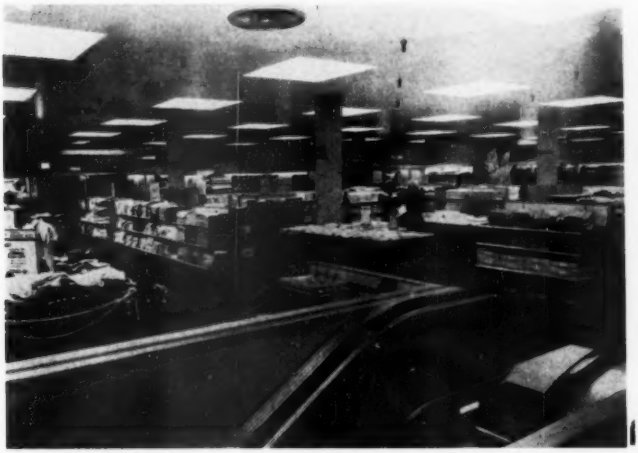


LOUVERED LUMINAIRE is used on all sales floors, with a gimble ring for mounting an incandescent flood lamp when required.

85-Watt Lamps Form 5-Foot Square Unit

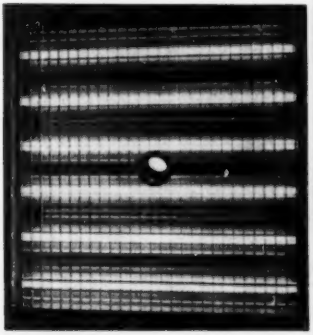
The new Wieboldt store in Evanston, Illinois, with 4½ acres of sales area, provides general lighting for merchandising with a ceiling-recessed 5-foot square unit. Each unit contains six 85-watt warmtone fluorescent lamps, mounted two to each of three 20-inch chassis. Eggcrate metal louvers for the square fixture are constructed in three sections, hinged and removable for easy maintenance and meshed to give the appearance of a single louvered section. The 18-inch center section is provided with a gimble ring, making it possible to insert a sideprong PAR-38 flood lamp in the fixture when added punch lighting is desired.

A total of 752 such fixtures is installed in the store, while the basic 20-inch-wide 2-lamp chassis is also installed singly and in pairs to bring the store's complete fixture count to over 2,000. In the event that higher levels of illumination are desired at a later date in areas now lighted by these one- or two-chassis installations, additional chassis may be provided to complete the 3-section unit.

Maintenance was a major consideration in the design of these luminaires. No-blink starters are used wherever applicable; lead wires are lugged to insure positive electrical contact; fuses are wired to ballast primaries and located on the outside of wireways for ready access; and many fixtures are equipped with top access panels, so that between-floor connections can be made when desired to systems primarily installed for showcases, floor receptacles and cash registers.

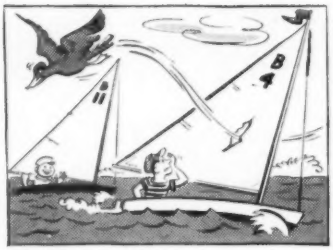
After 500 hours of service, counter tops received 39 footcandles of illumination from the fluorescent lamps alone; 75 footcandles in the beams of the sideprong PAR-38 flood lamps. Fixtures are installed in the 11-foot ceiling on a 13-by-13-foot pattern.

Work surfaces, counters and wall



SQUARE UNIT contains six 85-watt lamps on 10-inch centers. Eggcrate louver shielding panel is equipped with center floodlamp.

MAINTENANCE is facilitated by accessible fuses on wireways; removable access panel for making wiring connections to above-ceiling circuits.



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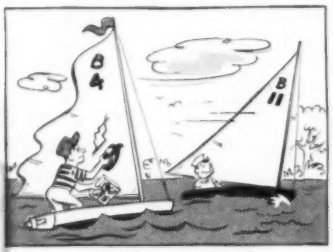
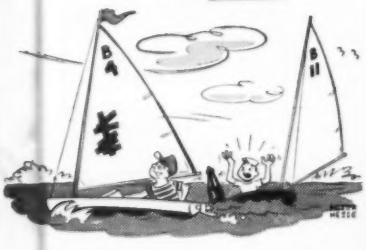


with a little



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cases are light natural-finish wood; floor areas are covered with mottled grey linoleum and grey carpeting; ceilings are of light grey plaster. Reflectances of all surfaces (excluding the ceiling) are approximately 35%. The ceiling is twice this value. Brightnesses, also, are fairly uniform, with values ranging from a 9 foot lamberts on ceiling surfaces between fixtures to 18 foot lamberts on counters. Brightness readings on the luminaires proper average 250 foot lamberts.

Designed by architects Holabird, Root and Burgee, the installation of the lighting system was by the Hatfield Electric Co. Fixtures were manufactured by All-bright Electric Products.

Luminous Ceiling for Residential Dining

The dining room in the home of Ray Forsythe, Birmingham, Michigan, is distinguished by a luminous ceiling, and an overhead multi-color fluorescent installation that permits the selection or blending of color and intensity for all occasions. This installation, in a room painted olive green with natural birch woodwork and furniture, a beige carpet and chartreuse upholstery, results in an atmospheric setting that is flexible, variable and decorative.

The room measures 15-by-16.5-feet, with a 9-foot 3-inch ceiling and a 5-foot

MULTI-COLOR fluorescent installation above luminous ceiling makes it possible to select and blend white, gold and pink light for variety of atmospheric objectives. Ceiling is Rohm and Haas plastic. Local lighting in glass-shelved china cabinets is provided by single-strip fluorescent border lamps.

AIR CHAMBER above ceiling is 5-feet high, with four rows of four lamps each mounted on ceiling. Three separate circuits permit the control of white, gold or pink lamps. Ceiling framework is Unistrut, suspended by hanger rods.

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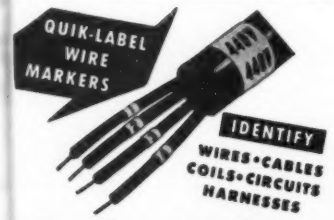

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air chamber above the luminous panel level. On the ceiling of this air chamber are mounted four rows of 40-watt single-lamp channels; each row containing 4 lamps. To provide a color selection for various occasions, the end lamps in the center rows are pink, the inside lamps on the outside rows are gold, and the remaining eight lamps are white. White lamps are single-pin instant start. Gold and pink lamps are bi-pin conventional start. Each color is separately circuited and switched to permit flexibility of control.

Natural daylight is also available, since an 8-by-4-foot skylight is centered above the ceiling.

Lining the air chamber is a covering of aluminum foil which serves the double purpose of heat insulation and light reflection.

The luminous ceiling, consisting of 30-by-32-inch Rohm and Hass ¼-inch panels, is supported by a birch framework screwed to the underside of a duplicate Unistrut frame, suspended at each intersection by rod hangers dropping from ceiling joists.

With all lamps in service, the artificial illumination at the center of the dining room table is 28 footcandles. Using only white lamps, the intensity is 17-ft-c. Gold, alone, provides 5.5-ft-c. with a similar intensity recorded when only pink lamps are in use. Intensities in the corners of the room are approximately 60% of center-table readings.

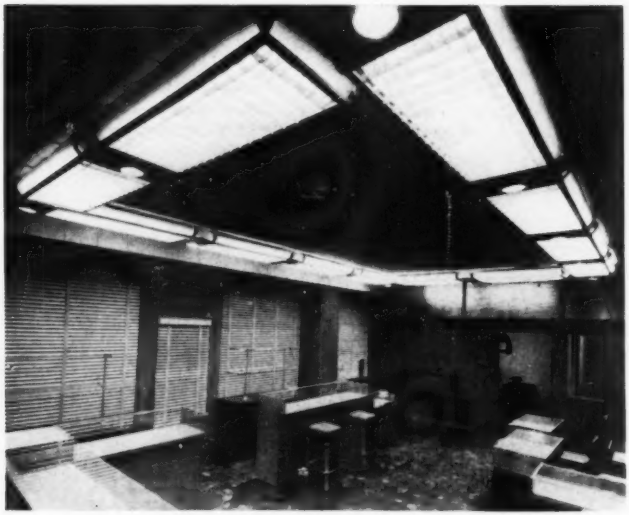
Rectangular Lighting Plan for Jewelry Store

The Jewelry Mart on South Broadway, Los Angeles, utilizes lighting intensities between 105 and 200 footcandles to attract customers, promote volume turnover and speed sales. The ceiling lighting plan, designed by Roy H. Kreyser of the Department of Water and Power, places 12 Globe Lighting 4-lamp fluorescent fixtures in a rectangle; four on each side and two at each end of the 28-by-19-foot showroom. Swiveling 150-watt PAR 38's are positioned between each fluorescent unit, giving to the area a pleasing color balance and making it possible to build up lighting intensities on specific examination or display sections.

The same type of fluorescent fixture with louvered bottom and luminous side panels is installed on the 11-foot ceiling of the private display room located off the central area. Swivel spots also are provided for accent lighting in this section. The total connected lighting load is 5.65-kw. The main sales area uses 8.6 watts per sq. ft.

The geometry of this ceiling lighting plan enhances the modern and clean simplicity of the central area. The PAR 38s relieve the monotony of the fluorescents, and provide useful and decorative light to the working area.

The installation was by electrical contractor Michael M. Gobetz & Company.



FLUORESCENT 4-lamp fixtures, placed in a rectangular pattern and interspersed with 150-watt PAR38s, provide 200-footcandles of illumination to display counters in Los Angeles Jewelry Mart.

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LIGHTING FOR Plant Protection

READY NOW! Complete, Up-To-Date Bulletin to assist in making plants, areaways, loading docks, etc. SAFE FROM ILLEGAL ENTRY!

Today, every foresighted plant executive is going into action on the subject of better plant protection against all intruders and trespassers. As pointed out by civic defense leaders in current newspaper articles, all plants, and especially those engaged in work vital to defense, should take immediate steps to prevent espionage and sabotage.

One of the principal measures recommended is LIGHTING FOR PLANT PROTECTION. Experience has proved that one of industry's first defense lines against illegal entry is LIGHT. When industry wraps its property in the shining armor of protective lighting, it erects a barrier through which few intruders dare to pass. Moreover, protective lighting is of tremendous aid to guards and police as it creates a "no man's land" which can be easily patrolled and in which any suspicious person is instantly detected.

Benjamin Distributors are ready to assist you in the planning of protective lighting systems. By consulting them you draw on Benjamin's 50 years' experience in the manufacture of lighting equipment.

The NEW BENJAMIN BULLETIN ON LIGHTING FOR PLANT PROTECTION brings you concise information to help you plan protective lighting for your plant areas. It contains complete data on Benjamin Lighting Units suitable for protective lighting and tells how and where to install them to fit the specific protective lighting problems, found in the lighting of fences, areaways, buildings, as well as such vulnerable spots as spaces along railroad tracks, narrow alleys between buildings, yard entrances, and streets that dead end at the property line.

This informative Bulletin is yours without cost or obligation. It may be obtained from your Benjamin Distributor or by writing to: Benjamin Electric Mfg. Co., Dept H, Des Plaines, Illinois.

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Industrial Electrification (DATA SHEET)

Trouble-Remedy Chart for Induction Motors

The following maintenance and repair hints are presented in check-list form for plant electricians. They follow a trouble-cause-remedy outline.

MOTOR WILL NOT START

Overload control tripped: Wait for overload to cool, then try starting again. If motor still does not start, check the causes outlined below.

Open fuses: Test fuses.

Low voltage: Check nameplate values against power supply characteristics. Also check voltage at motor terminals with motor under load to check wire size.

Wrong control connections: Check connections with control wiring diagram.

Loose terminal-lead connection: Tighten connections.

Driven machine locked: Disconnect motor from load. If motor starts satisfactorily, check driven machine.

Open circuit in stator or rotor winding: Check for open circuits.

Short circuit in stator winding: Check for short.

Winding grounded: Test for grounded wiring.

Bearings stiff: Free bearing or replace.

Overload: Reduce load.

MOTOR NOISY

Motor running single phase: Stop motor, then try to start. It will not start on single phase. Check for open circuit in one of the lines.

Electrical load unbalanced: Check current balance.

Shaft bumping (sleeve-bearing motors): Check alignment and conditions of belt. On pedestal-mounted bearing check cord play and axial centering of rotor.

Vibration: Driven machine may be unbalanced. Remove motor from load. If motor is still noisy, rebalance.

Air gap not uniform: Center the rotor and if necessary replace bearings.

Noisy ball bearings: Check lubrication. Replace bearings if noise is excessive and persistent.

Rotor rubbing on stator: Center the rotor and replace bearings if necessary.

Motor loose on foundation: Tighten hold-down bolts. Motor may possibly have to be realigned.

Coupling loose: Insert feelers at four places in coupling joint before pulling up bolts to check alignment. Tighten coupling bolts securely.

MOTOR AT HIGHER THAN NORMAL TEMPERATURE OR SMOKING

Overload: Measure motor loading with ammeter. Reduce load.

Electrical load unbalance: Check for voltage unbalance or single-phasing.

Restricted ventilation: Clean air passage and windings.

Incorrect voltage and frequency: Check nameplate values with power supply. Also check voltage at motor terminals with motor under full load.

Motor stalled by driven machine or by tight bearings: Remove power from motor. Check machine for cause of stalling.

Stator winding shorted or grounded: Test windings by standard method.

Rotor winding with loose connections: Tighten, if possible, or replace with another rotor.

Belt too tight: Remove excessive pressure on bearings.

Motor used for rapid reversing service: Replace with motor designed for this service.

BEARINGS HOT

End shields loose or not replaced properly: Make sure end shields fit squarely and are properly tightened.

Excessive belt tension or excessive gear side thrust: Reduce belt tension or gear pressure and realign shafts. See that thrust is not being transferred to motor bearing.

Bent shaft: Straighten shaft or send to motor repair shop.

SLEEVE BEARINGS

Insufficient oil: Add oil—if oil supply is very low, drain, flush and refill.

Foreign material in oil or poor grade of oil: Drain oil, flush and relubricate using industrial lubricant recommended by a reliable oil manufacturer.

Oil rings rotating slowly or not rotating at all: Oil too heavy; drain and replace. If oil ring has worn spot, replace with new ring.

Motor tilted too far: Level motor or reduce tilt and realign if necessary.

Rings bent or otherwise damaged in reassembling: Replace rings.

Ring out of slot (oil-ring retaining clip out of place): Adjust or replace retaining clip.

Defective bearings or rough shaft: Replace bearings. Resurface shaft.

BALL BEARINGS

Too much grease: Remove relief plug, and let motor run. If excess grease does not come out, flush and relubricate.

Wrong grade of grease: Add proper grease.

Insufficient grease: Remove relief plug and regrease bearing.

Foreign material in grease: Flush bearings, relubricate; make sure grease supply is clean. (Keep can covered when not in use.)

Source of data: General Electric Co., Apparatus Department

Trouble-Remedy Chart for DC Motors and Generators

The following maintenance and repair hints are presented in check-list form for plant electricians. They follow a trouble-cause-remedy outline.

MOTOR WILL NOT START

Open circuit in control: Check control for open starting resistor, open switch for burned fuse.

Low terminal voltage: Check voltage with nameplate rating.

Bearing frozen: Recondition shaft and replace bearing.

Overload: Reduce load or use larger motor.

Excessive friction: Check lubrication in bearings to make sure that the oil has been replaced after installing motor. Disconnect motor from driven machine and turn motor by hand to see if trouble is in motor. Straighten or replace bent or sprung shaft (machines under 5 hp).

EXCESSIVE SPARKING

Poor brush fit on commutator: Sand the brushes and polish commutator surface.

Brushes binding in the brush holders: Remove irregularities on surfaces of brush holders, rough spots on the brushes; clean with lint free cloth.

Insufficient or excessive pressure on brushes: Adjust brush spring pressure.

Brushes off neutral: Set brushes on neutral.

SPARKING AT LIGHT LOADS

Paint spray, chemical, oil, grease or other foreign material on commutator: Use motor designed for application. Clean commutator and provide protection against foreign matter. Install an enclosed motor designed for the application.

FIELD COILS OVERHEAT

Short circuit between turns or layers: Replace defective coil.

COMMUTATOR OVERHEATS

Brushes off neutral: Adjust brushes.

Excess spring pressure on brushes: Decrease brush-spring pressure but not to the point where sparking is introduced.

GROOVING OF COMMUTATOR

Brushes not properly staggered: Stagger brushes.

MOTOR ATTEMPTS TO START BUT OVERLOAD RELAYS OPERATE

Motor is started with weak or no field: If adjustable-speed motor, check rheostat for correct setting. If correct, check condition of rheostat. Check field coils for open windings. Check wiring for loose or broken connections.

Motor torque insufficient to drive load: Check line voltage with nameplate rating. Use larger motor or one with suitable characteristic to match load.

MOTOR RUNS TOO SLOWLY UNDER LOAD

Line voltage too low: Check and remove any excess resistance in supply line, connections or control.

Brushes ahead of neutral: Set brushes on neutral.

Overload: Check to see that load does not exceed allowable load on motor.

MOTOR RUNS TOO FAST UNDER LOAD

Weak field: Check for resistance in shunt-field circuits. Check for grounds.

Line voltage too high: Correct high-voltage condition.

Brushes back of neutral: Set brushes on neutral.

SPARKING BRUSHES

Commutator in bad condition: Clean and reset brushes.

Eccentric or rough commutator: Grind and true commutator, also undercut mica.

Excessive vibration: Balance armature. Check brushes to make sure they ride freely in the holders.

Broken or sluggish-acting brush-holder spring: Replace spring, and adjust pressure to manufacturer's recommendations.

Brushes too short: Replace brushes.

Machine overloaded: Reduce load or install larger motor.

Short circuit in armature: Check commutator and remove any metallic particles between segments. Check for short between adjacent commutator risers. Test for internal shorts in armature and repair.

BRUSH CHATTER OR HISSING NOISE

Excessive clearance of brush holders: Adjust holders.

Incorrect angle of brushes: Adjust to the correct angle.

Incorrect brushes for the service: Get manufacturer's recommendations.

High mica: Undercut mica.

Incorrect brush-spring pressure: Adjust to correct value.

SELECTIVE COMMUTATION

(One brush takes more load than it should)

Insufficient brush-spring pressure: Adjust to correct pressure, making sure brushes ride free in holders.

Unbalanced circuits in armature: Eliminate high resistance in defective joints by inserting armature or equalizer circuit or commutator risers. Check for poor contacts between bus and bus rings.

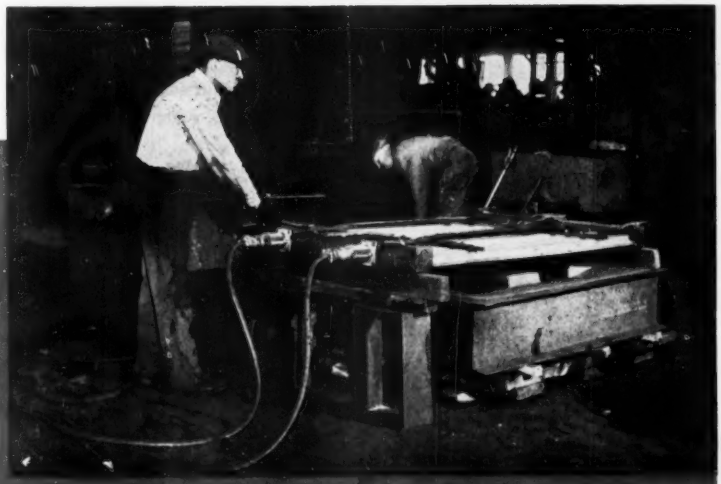
BRUSHES WEAR RAPIDLY

Rough commutator: Resurface commutator and undercut mica.

Excessive sparking: Make sure brushes are in line with commutator fields.

Source of data: General Electric Co., Apparatus Department

TIREX HELPS TAKE THE BUBBLES OUT OF STEEL CASTINGS



Foundries "skin dry" molds so that the molding sand will not give off a gas and cause bubbles or porosity in the casting.

Until a short time ago it was common practice in most foundries to skin dry molds with an open kerosene torch. It was slow, hot, dirty, disagreeable work and a moment's inattention could result in a burned and spoiled mold.

A Milwaukee foundry decided to get rid of this dirty, slow job of skin drying molds. They had infrared ray heaters developed. These heaters not only did away with the drudgery of the job but gave the foundry several unexpected dividends. First, the labor of the man drying the mold was eliminated. Second, spoiled molds became a thing of the past. But better still, because the infrared ray heaters were faster than the open kerosene torches, it was possible to dry an additional mold each day and that is a considerable dividend.

Of course the infrared ray heaters demanded a dependable pathway for power and that they got in TIREX Cables. This picture shows TIREX Cables connected to the heaters. TIREX not only operates dependably day in and day out but it safely combats the sharp abrasive foundry sand, it eliminates the danger from cable fires caused by flying molten metal sparks, and it takes in its stride the everyday abuse that is part of the job.

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Simplex research gave you the first heavy duty, rubber-jacketed portable cord or cable; the first low water absorption insulation; the first rubber-jacketed underground cable. Besides these notable "Firsts" Simplex research has provided a great many developments which have enriched the art of cable design.

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Trouble-Remedy Chart for Synchronous Motors

The following maintenance and repair hints are presented in check-list form for plant electricians.

MOTOR WILL NOT START

Faulty connection: Inspect for open or poor connection.

Open circuit one phase: Test, locate and repair.

Short circuit one phase: Open and repair.

Voltage falls too low: Reduce the impedance of the external circuit.

Friction high: Make sure bearings are properly lubricated. Check bearing tightness, belt tension, load friction, alignment.

Field excited: Be sure field-applying contactor is open, and field-discharge contactor is closed through discharge resistance.

Load too great: Remove part of the load.

Automatic field relay not working: Check power supply to solenoid, check contactor tips and connections.

Wrong direction of rotation: Reverse any two main leads.

MOTOR WILL NOT COME UP TO SPEED

Excessive load: Decrease the load. Check operation of unloading device (if any) on driven machine.

Low voltage: Increase voltage.

Field excited: Be sure field-applying contactor is open, and field-discharge contactor is closed through discharge resistance.

FAILS TO PULL INTO STEP

No field excitation: Check circuit connections. Be sure field-applying contactor is operating. Check for open circuit in field or exciter. Check exciter output. Check rheostat. Set rheostat to give rated field current when field is applied. Check contacts of switches.

Load excessive: Reduce load. Check operation of unloading device (if any) on driven machine.

Inertia of load excessive: May be a misapplication; consult data.

MOTOR PULLS OUT OF STEP OR TRIPS BREAKER

Exciter voltage low: Increase excitation. Examine exciter as for dc motors. Check field ammeter and its shunt, to be sure reading is not higher than actual current.

Open circuit in field, and exciter circuit: Test with magneto and repair break.

Short circuit in field: Check with low voltage and polarity indicator and repair field.

Reversed field spool: Check with low voltage and polarity indicator and reverse incorrect leads.

Load fluctuates widely: Refer to remarks below, under Motor "hunts".

Excessive torque peak: Check driven machine for bad adjustment, or consult motor manufacturer.

Power fails: Re-establish power circuit.

Line voltage too low: Increase if possible. Raise excitation.

MOTOR "HUNTS"

Fluctuating load: Correct excessive torque peak at driven machine or consult motor manufacturer. If driven machine is a compressor, check valve operations. Increase or decrease flywheel size. Try decreasing or increasing motor field current.

STATOR OVERHEATS IN SPOTS

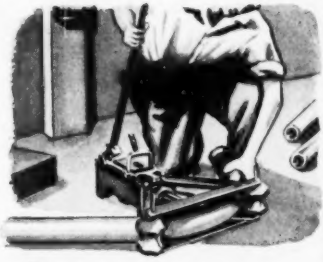
Rotor not centered: Realign and shim stator or bearings.

Open phase: Check connections and correct.

Unbalanced currents: Loose connections. Improper connections.

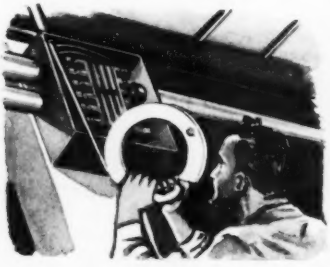
Source of data: General Electric Co., Apparatus Department

"Hey Boss, we finished two hours early!"



We used Triangle conduit and wire all the way through and right from the start things went smooth. Take the conduit, for instance. This Triangle hot-dipped galvanized conduit bends easy and what I like best is that it doesn't flake on the bends. We really saved time working with conduit like that.

We used Triangle power cable and varnished cambric—lots of it! This big stuff is easy to handle and we saved plenty of time there. Every foot was right, nothing to reject.



On the branch circuits we used Triangle's Glazon. It's got a smooth finish and small outside diameter that makes it easy to pull, and it's free stripping.

That's about it, Boss. We can go over to that other job now — the one we didn't think we could tackle until tomorrow.

Yes-Sir, when it comes to quality wire, cable and conduit — Triangle Must Be Right! Why don't You specify Triangle on Your next job? Ask your jobber — he knows, It Must Be Right.

THE TRADE-MARK OF TOP QUALITY!

TRIANGLE CONDUIT & CABLE CO., INC.

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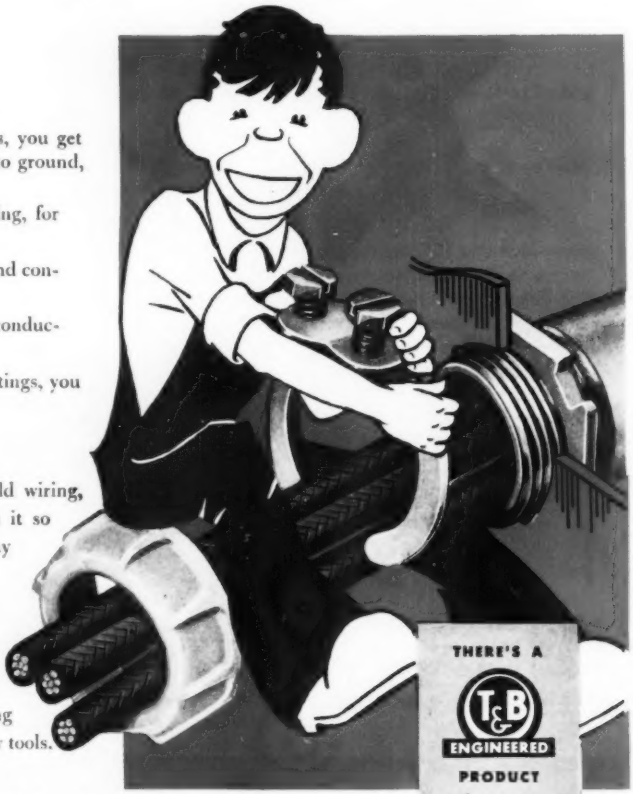

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1. Bonding screw bites firmly into bushing, for a tight wedge and a lasting bond
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And with these universally approved fittings, you get quick inspection OK's.

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You can slip the wedge right over old wiring, without disturbing it at all. You turn it so screws are easy to tighten. You do away with inside lock-nuts—and most of the time, with bonding jumpers too. (If you do need a jumper, just connect it to the bonding screw.) You convert standard bushings, of all conduit sizes, to approved grounding bushings in a few seconds, with ordinary tools.

THERE'S A T&B ENGINEERED PRODUCT for every wiring job in the complete T & B line of fittings for all conductors and raceways.

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In The News

Kansas City Contractors Rehabilitating Flood Stricken Industries

Hard hit by the recent devastating Kansas City flood was a large portion of the city's industrial area in the lowlands at the juncture of the swollen Missouri and Kansas rivers. Hundreds of plants were under 10 to 20 feet of muddy water for several days. As the flood waters receded, thousands of electric motors, switchboards, controls, transformers and circuits emerged thoroughly water-soaked and dripping silt.

To get the plants back into operating condition at the earliest possible moment, the electrical industry in Kansas City has banded together as a well organized team. Under the leadership of Jack A. Scheffer, Manager of the Greater Kansas City Chapter, NECA, some 35 electrical contractors, 1,600 electricians, 10 electrical wholesalers and 15 motor repair shops with their staffs are engaged in an all-out effort to speed rehabilitation.

Flood work is given preference over all other projects. Electricians are being pulled from going jobs and sent to inundated plants. Local 124, IBEW (A.F.L.) members are working side by side with CIO plant maintenance electricians. Wholesalers, who sensed the need for materials, expedited deliveries of orders pending, and are giving first call to material and equipment requests from flooded plants. To date most of the electrical material requirements are being met from wholesalers' stocks. What one supplier can't furnish, another will.

Contractors and motor shop operators are pooling such special equipment as steam generators, carbon tetrachloride spray units (to clean and dry switches and controls), portable type bake ovens and numerous other items. Contractors unable to handle additional flood work relay such requests to the NECA chapter headquarters where other less-busy contractors are canvassed. All manpower requests and assignments are channeled through the NECA chapter. Latest report indicates a need for about 400 more electricians.

To save valuable time normally required in estimating costs, most of the work is being done on a time and material basis. All material and equipment that can be salvaged is being re-used. And there is no question of competition. To get the job done, two and three contractors may work in a single plant. The local electrical inspection department cooperates by issuing permits by telephone to contractors, but makes a careful inspection of the work before a certificate is granted. No power will be connected by the utility without such a certificate of inspection.

To guide NPA in granting material inventory relief to wholesalers and contractors, the Kansas City electrical industry estimated (preliminary) flood rehabilitation needs as follows: 2,030,000 pounds of copper; 190 tons of steel; 80,000 pounds of aluminum; and 300,000 pounds of lead. This to cover electrical utilities, industrial motors and control, industrial wiring and lighting, telephone, residential lighting, fire alarms, meters, plant communications and lead cable sheathing.

Through NECA's Kansas City chapter and its Washington office, NPA was apprised of the electrical plight of the inundated plants. A special miniature NPA organization has been set up in Kansas City to see that necessary materials are secured. While the contractors are at present working under a special temporary certification "that the material on this order is the minimum replacement requirements after maximum salvage effort in the Missouri-Kansas flood emergency," latest reports indicate the NPA emergency mission in Kansas City will favor ordering materials in the normal manner with regular suppliers and will stand ready to fill such requirements as determined by the suppliers on the basis of what the customer needs.

Biggest concern of contractors, wholesalers and suppliers is whether materials now being used in flood rehabilitation will be charged against their normal allotment and thus deprive them of materials to complete their regular cotnract commitments. All are awaiting a definite directive from NPA and an assurance that flood rehabilitation requirements will be given special allocation treatment. Despite this cloud of uncertainty, all are pitching in to get plants in operation as early as possible.

Wage Control for Construction Industry

A special regulation covering the control of wages and salaries of on-site mechanics and laborers has been adopted by the Construction Industry Stabilization Commission and approved by the Wage Stabilization Board. CISC Reg. No. 1 adheres to the principle that construction wages should be stabilized on an area basis, as suggested by WSB in its Reg. No. 12 creating the Construction Commission.

It (1) specifies that, for the present, five WSB regulations will not apply in the construction industry, (2) explains what rates contractors may pay without the necessity of seeking government approval and (3) tells how approval may be sought for rates which require advance approval.

WSB regulations which will not apply in construction are Nos. 5 (Individual Increases Based on Merit, Promotion, etc.), 6 (The 1-PC Catch-Up Formula), 8 (Cost-of-Living Escalators), 9 (New Plants) and 10 (Tandem Increases).

The Regulation gives prior approval—a contractor may pay them without seeking the Government's O.K.—to the following rates:

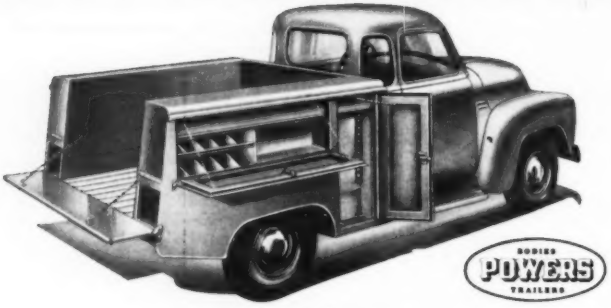
(1) Rates predetermined by the Secreary of Labor. This applies to rates on Federal work subject to these laws: Bacon-Davis, National Housing, Federal Airport, Housing Act of 1949, and School Survey and Construction Act of 1950.

(2) Approved area rates. These are rates approved by CISC (the Commission) and published in the Federal Register as applicable specific job classifications on specific type of construction in an area. Exception: a contractor who raises his rate to the area rate, then reduces it, may not again increase the rate without first getting CISC approval.

(3) Where no approval rates exist. A contractor may pay the legal rates being paid under union contract in the area. If there is no union contract, he may pay the prevailing legal rates in the area.

(4) Travel. You can pay actual travel time at the authorized rate, and for actual travel expense, when the employee has to report at your shop or at any other particular site and later in the day is required to travel to a different working site.

ARE YOU LOSING $319.37 PER YEAR



or do you have a

Service-Master

"the electrician's service body?"

With your present truck you probably spend 15 minutes a day looking for parts or returning to your shop. If your service charge is $3.50 per hour, you lose $319.37 yearly.
Service-Master saves this unproductive time by taking a complete workshop to *every* job. Parts are easy to find—in weathertight compartments which can be locked to prevent theft. What's more, there's plenty of room for bulky items in the larger-than-a-pick-up cargo space. Get further details, today—just mail the coupon below.

Available for immediate delivery in all 48 states

Look at all the features you get in a POWERS Service-Master:

Fully enclosed wheelhousings protect underside of compartments and strengthen side panels; one-piece, ribbed-steel floor distributes weight evenly and prevents sagging at any point; all-steel body shell is electrically welded to form one complete unit; can be mounted on new or used chassis and easily transferred from one unit to another.

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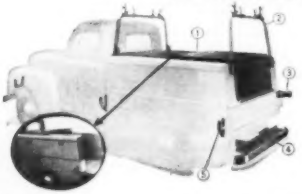

1. Removable overhead rack.
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567

(5) Premium pay. Conditions under which you may pay travel expenses, travel time, subsistence, premium pay for work outside the regular workday or workweek, vacation allowances, holiday pay or make contributions for welfare benefits, insurance, pensions or annuities: (1) if the payments are in accordance with an established area practice; or (2) if the practice is approved by CISC as an area practice; or (3) if the contractor had previously personally established the practice, without violating wage stabilization.

(6) Rates above area rates. If you are paying rates above the approved area rates—and they do not violate wage stabilization—you may continue to pay those higher rates until completion of the project or until expiration of the construction contract under which the work is being done, whichever comes first. After that, you may not pay above the area rate.

Applications for the establishment or revision of an area rate or rates should be filed with the Construction Industry Stabilization Commission, U. S. Department of Labor, Washington 25, D. C. Form 1, now in preparation, should be used in filing applications.

IES Midwestern Regional Conference

The Illuminating Engineering Society's Midwestern Regional Conference, attended by approximately 200 members and guests, was held at the Blackhawk Hotel May 18-19 in Davenport, Iowa. Participating were the Chicago, Twin City (Minneapolis-St. Paul), St. Louis and Iowa Sections, and the Cornhusker, Heart of America, Indiana, Milwaukee Chapters of the Society. The Iowa Section, Chairmanned by W. Dean Barnhizer of the Iowa Electric Light and Power Company, Cedar Rapids, Iowa, was host.

The first day's session was opened by W. Dean Barnhizer.

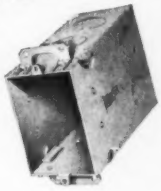
First speaker on the program was Walter Sturrock, national president of the Society, who talked on the subject, "Where Do We Serve Today?". He outlined the part that IES and its members can and should play in the present defense mobilization program, including the various fields of lighting which must be kept alive during the emergency period.

Other speakers and subjects included: W. H. Kahler, Westinghouse Elec. Corp., Cleveland—"Industrial Production Improves With Proper Lighting;" R. L. Oetting, G. E. Co., Nela Park—"Evaluation of Lighting Techniques for Offices and Drafting Rooms;" L. S. Oyster, E. I. duPont de Nemours,

Our Very Own!

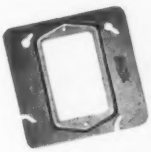
SBS—Strong, secure mounting in all kinds of wall materials. Can be pulled tighter at any time.

The Raco line of switch and outlet boxes is much more than an unusually complete line, designed to meet every need and preference in its field. Almost every item (like the four examples shown) has some special feature, Raco engineered to make that unit just a little better than run-of-the-mill merchandise. That's why Raco is the line to stay with.



RDD—3½" deep boxes for modern tile or block walls. 1½" deep boxes for "thin-wall" partitions.

40-X—Especially for remodeling work. Conductors run under new furred-out walls. No disturbing old outlet.



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"A BOX FOR EVERY NEED"

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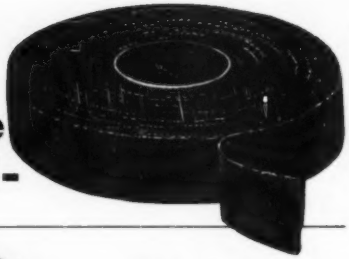

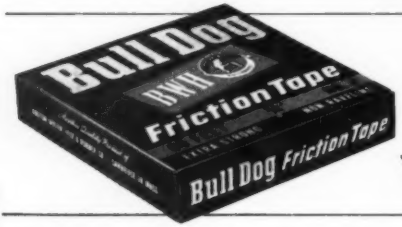

-When It's Coverage You Want?

Buying friction tape by the pound is more than just "old-fashioned" — it's downright expensive.

You'll save money by making it a point always to buy BULL DOG FRICTION TAPE . . . the tape that comes in rolls of guaranteed footage.

Too, you'll save with BULL DOG because it doesn't dry out on the roll or on the job . . . never ravels, wrinkles or frays, either!

All electrical men who've tried BULL DOG stay with it. You try it . . . you'll like it too.

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DUAL SILVER POINT — FULLY AUTOMATIC

FLUORESCENT STARTERS

-completely eliminate annoying blinking and flickering of dead fluorescent lamps!

GUARANTEED — FOR ONE YEAR!

This is a glow switch condenserless precision starter equipped with automatic thermal relay circuit breaker. The relay automatically removes the lamp from the circuit electrically when the lamp becomes de-activated and automatically resets upon interruption of the lamp circuit.

SIMPLIFIES — Replacement of defective lamp automatically recycles starter circuit. No buttons to push — no replacement of starter.

REDUCES COST — Magno-Tronic starters provided exact timing of electrode heating, preventing excessive loss of emission material, thus assuring maximum possible lamp life.

VERSATILE — Built to operate efficiently over an extended voltage and temperature range.

SP-15-20 For use with 15 or 20 watt lamps.
SP-30-40 For use with 30 or 40 watt lamps.
SP-85-100 For use with 100 watt lamps.

Manufactured under U. S. PATENTS

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Other Patents Pending

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General Offices & Main Plant, 80 BANK STREET, NEWARK 2, N. J.

& Co., Inc., Chicago—"Color Conditioning"; and R. J. Diefenthaler, G. E. Co., Chicago — "Localized Lighting and Inspection Problems".

After a Hospitality Hour, the evening banquet was presided over by C. N. Laupp, Regional Vice-President.

Speaker of the evening was Berlon C. Cooper, Eastern Editor, *Electrical Construction and Maintenance*, New York, who discussed, "The Electrical Industry's Place in Lighting for Production and Mobilization . . .New Frontiers in Lighting". He reviewed the present status of federal controls on materials, manpower, construction and prices, and pointed up the tremendous market for lighting equipment and wiring in the mobilization program.

A. B. Halloway, Twin-City Section, was chairman of the final session and talks were given by Melvin H. Galbraith, Approved Lighting Service, Cedar Rapids, Iowa; H. U. Hjernstad, vice-president, Sola Electric Co., Chicago; and E. H. Grieb, Holophane Co., Inc., Wauwatosa, Wis.

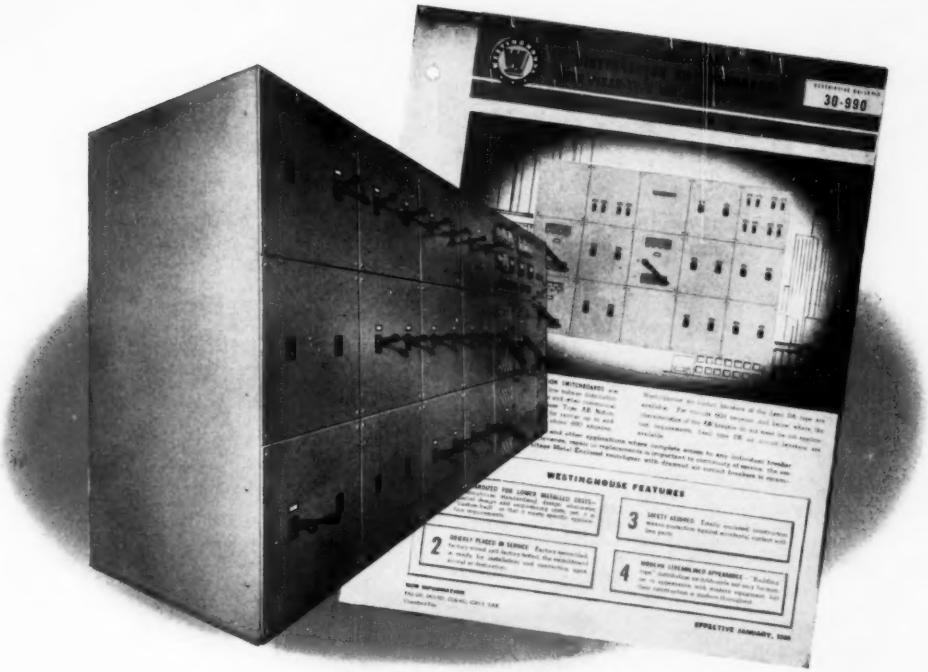
N. Y. State Electrical Contractors Meet

"Our Goal—National Security" was the theme of the 52nd annual convention of the New York State Association of Electrical Contractors and Dealers, Inc., held at Saranac Inn, N. Y., from June 30th to July 7th. More than 400 representatives of the electrical industry attended.

A. Lincoln Bush, president of Belmont Electric Co., New York, was chairman of the opening session. In his address of welcome, A. A. A. Tuna, president of the Association, urged the electrical contracting industry to apply its skill and know-how to the defense program. "Electrical Inspectors Assistance—National Security" was discussed by James D. Lynett, Superintendent, the New York Board of Fire Underwriters.

Herman L. Weisman, counsel, Joint Industry Board of the Electrical Industry, New York, presented "Some Observations on Democracy, Patriotism and Competition." He called upon business men to take the offensive and destroy the illusion that communism has a monopoly on ideology for the benefit of the working people. Communism means enslavement of the working citizens of a nation. The truth is, Mr. Weisman said, that the American ideology of free enterprise and a guarantee of personal liberty is a fighting faith that can keep the entire world free, prosperous and at peace.

Utilities Day was chairmanned by Franklin S. Koons, vice president,



Check these Advantages of Westinghouse "BUILDING-TYPE" Distribution Switchboards

Specifically designed for control of low-voltage distribution circuits in commercial buildings, Westinghouse Building-Type Switchboards provide low-cost circuit protection with these advantages:

. . . Where Westinghouse Type AB Nofuze "De-ion"® Circuit Breakers up to 600 amperes are suitable, these compact breakers keep cost and space to a minimum.

. . . Where circuit requirements are such that AB Breakers cannot be used, and for ratings above 600 amperes, stationary mounted Westinghouse Type DB Air Circuit Breakers are used.

Further, standardized design permits incorporating both Type AB and Type DB Breakers in the same structure.

Standardized design also makes installation easier, because switchboards are shipped as single structures or complete boards, depending upon your handling facilities.

Bulletin D.B. 30-990 gives the complete story on how to figure your requirements quickly and simply.

You can make selections right from this catalog. Structural numbers, operating parts and assemblies with layout instructions are illustrated, described.

Your Westinghouse representative will be glad to give you a copy of the booklet, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-93468

YOU CAN BE SURE... IF IT'S
Westinghouse
"Building Type" Distribution
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6 important advantages

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DRY TYPE TRANSFORMERS

300 KVA dry type. Sizes from 50 VA to 1000 KVA. Special sizes built to specific requirements.

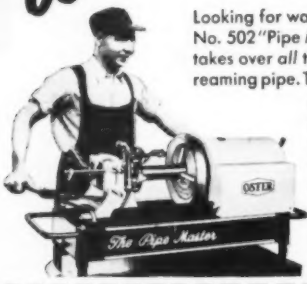
1 — Increased efficiency of lighting and motors; 2 — Low-cost movability for relocation; 3 — Out-of-way installation of small transformers; 4 — Indoor installation of substation sizes; 5 — Less and easier maintenance; 6 — Saving of space and enclosure construction costs.

POWER, DISTRIBUTION, INSTRUMENT, STREET LIGHTING AND TESTING TRANSFORMERS — OIL, ASKAREL OR AIR-COOLED

THE STANDARD TRANSFORMER COMPANY
WARREN, OHIO • OFFICES IN PRINCIPAL CITIES

It's time to cut Costs!

Looking for ways to cut your costs? Then look to the Oster No. 502 "Pipe Master." This complete power pipe machine takes over *all* the hard work of threading, cutting-off, and reaming pipe. Time saved means less cost on every pipe job.



Equipped with the exclusive "Auto-Grip" (automatic gripping front chuck) the Oster "Pipe Master" is the most complete machine of its type on the market—*yet costs no more than less complete threaders!*

Standard range ¼" to 2" pipe. Extra range ⅛" pipe. Range with drive shaft 2½" to 8" pipe. Bolt range ¼" to ½".

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O. K. Oster—send me all the facts on the Oster No. 502 "Pipe Master."
(Attach this to your letterhead or a postcard, fill in your name, company name and address and mail to "Oster.")

GET THE WHOLE STORY IN THE OSTER CATALOG

Long Island Lighting Co., Mineola, N. Y. Talks were given by Arthur L. Herbert, Long Island Lighting Co., James Kimball, Sperry Gyroscope Co., Lake Success, N. Y., Robert B. Denhardt, Central Hudson Gas & Electric Corp., Poughkeepsie, James W. Carpenter, Long Island Lighting Co.

Carl J. Schlaick, General Electric Supply Corp., New York, was chairman on Manufacturers and Wholesalers Day. Speakers were Raymond G. Oakley, Westinghouse Electric Corp., New York; Robert J. Sloan, Crouse-Hinds Co., Syracuse; Howard E. Bennett, General Electric Co., New York; and S. J. Rosch, Anaconda Wire & Cable Co., New York.

At the concluding session of the convention, the following officers were elected to serve next year: Chairman, E. G. May, Albany; vice-chairman, A. A. A. Tuna, New York; 2nd vice president and secretary, H. F. Janick, Rochester; treasurer, James F. Burns, Schenectady; and directors, E. G. May, William Aldrich, Ray Mitchell and A. A. A. Tuna.

NISA News

Officers chosen to head other chapters are:

Quaker City Chapter (Philadelphia) —President—J. B. Wagner, Wagner Electric Service; vice president—W. J. Engel, T. B. McCabe Co.; secretary—F. A. Schaef, Frank Schaef Associates; treasurer—W. M. Hendrickson, W. M. Hendrickson & Company.

King Coal Chapter (Southern Illinois) — *President* — O. D. Whitfield, Whitfield Electric Co., Madisonville, Ky.; vice president—H. L. Chase, Giles Armature & Electric Works, Marion, Ill.; secretary-treasurer—F. Schlageter, Klein Armature Works, Centralia, Illinois.

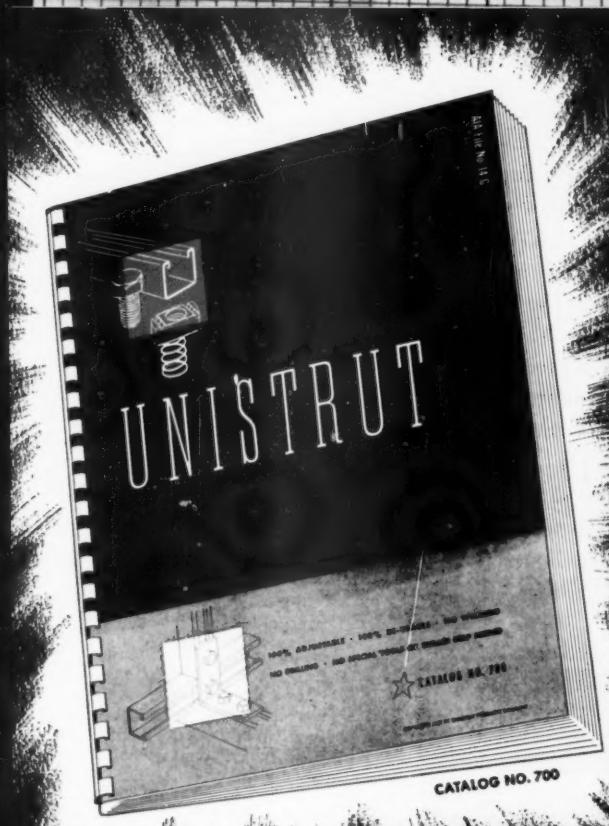
Louisville Chapter (Kentucky) — President— Wm. C. Krauth, Wm. C. Krauth Electric Co.; vice president —Carl M. Grubbs, Electrical Tool Service Co.; secretary—Owen Gollar, Owen Gollar Electric Co.; treasurer —E. M. Murphy, Marine Elec. Co.

Great Lakes Chapter (Michigan) —President—J. F. Dudley, Dudley Electric Works, Flint; vice president —George C. Glenning, Spaulding Electric Co., Detroit; secretary—J. G. Spaulding, Jr., Spaulding Electric Co., Detroit; treasurer—Charles H. Howard—Howard Electric Co., Detroit.

New Orleans Chapter (La.)—Miles Hutson, Industrial Electric Co., is the new secretary-treasurer.

•

Raymond E. Wilson is the new staff engineer for the National Industrial Service Association, Inc., succeeding D. W. Rust who resigned.



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78 Illustrated Pages on How to Frame, Hang, Support and Mount many kinds of Mechanical and Electrical Equipment with UNISTRUT All-Purpose Metal Framing

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UNISTRUT is metal channel with a continuous slot. You simply insert the UNISTRUT spring-held clamping nut into the channel at approximate point where attachment of another framing fitting is desired, slide to exact location and bolt to UNISTRUT fitting.

UNISTRUT includes concrete inserts, roller pipe supports, brackets, clamps and many other standard parts which in combination provide the world's most flexible system of support or suspension. UNISTRUT does the complete job—you need no other parts or materials.

UNISTRUT is trim framework—provides great strength without bulk. It's easy to work with, lasts indefinitely, and the finished structure assures neat and orderly appearance.

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GIVES YOU THIS FAST CLAMPING, LOCKING ACTION AND THIS COMPLETE ADJUSTABILITY AND RE-USABILITY

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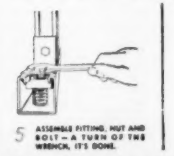
2 SERRATED GROOVES "BITE INTO" INTURNED EDGES OF CHANNEL FOR POSITIVE CLAMPING ACTION.



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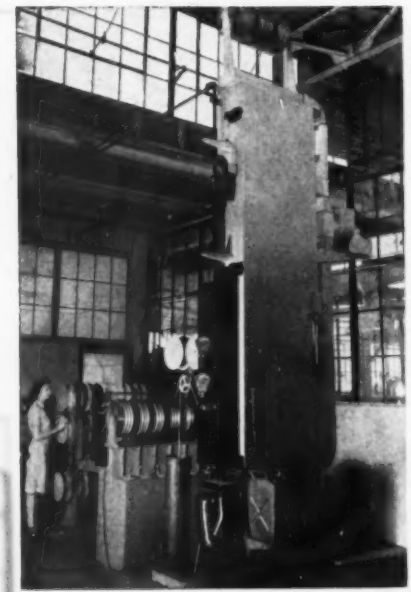


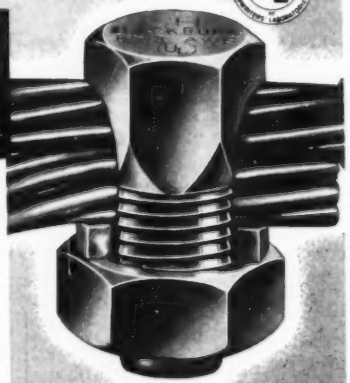
National Electric Coil Co. sleeving and tubing is braided in our plant, then varnish impregnated and baked under automatic control in this tower, designed by National engineers. Uniform high quality is insured. Just *try* it.

NATIONAL ELECTRIC COIL COMPANY
COLUMBUS 16, OHIO, U. S. A.

Make BETTER CONNECTIONS with HIGH PRESSURE!

BLACKBURN *Hi-Strength* CONNECTORS

Avoid "loose joint" trouble and the cost of running it down; use BLACKBURN Hi-Strength Connectors! Tests show that they definitely produce higher pressure connections — *trouble-free* connections. It costs less to use the best — use BLACKBURN. UL Approved from No. 10 to 1,000,000 CM.



Jasper Blackburn Corporation
35 MADISON ST. • ST. LOUIS 6, MO.
Phone CEntral 3007

Queens Electric Motors on May 28 celebrated its 15th anniversary with an open house held at its plant in Jamaica, N. Y. Over 450 people attended the exhibits and demonstrations of the shop facilities.

Two new NISA local chapters were added recently.

Ontario chapter was organized with an inaugural meeting on June 9th at Prince Edward Hotel in Windsor.

The following officers were elected: President—R. B. Turner of Johnson-Turner Electric Repair and Eng. Co., Windsor; Secretary—N. W. Finnie—The Ampere Electric Limited, St. Catherines; Treasurer — Ross Sawle—Blenkhorne & Sawle Electric Co., St. Catherines; and Publicity Chairman — Harold Berlet — Super Motor & Lighting Limited—Kitchner.

Changeover from 25 to 60 cycle undertaken by Hydro Electric Power Commission of Ontario provided points for discussion.

Northwestern-Central Ohio Chapter held first meeting and luncheon at the plant of the Springfield Electric Motor Company.

Officers elected were: President—E. G. Potter—Lima Armature, Lima; Vice President—B. R. Schoemaker—Shoemaker Electric Co., Columbus; Secretary—Harry M. Kollus—Reliable Electric Co., Zanesville; Ass't Secretary—H. E. Girkins—Girkins Electric Co., Toledo; and Treasurer—Earl Miller — Springfield Electric Co., Springfield.

From Walter J. Prise The Maintenance Company, Inc, New York.

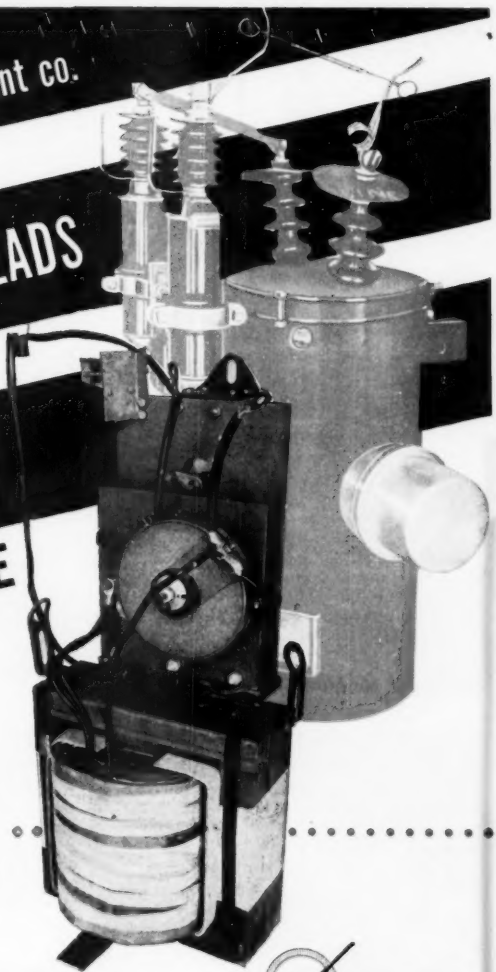
New Light Source

The recent demonstration of a new light source by Sylvania Electric Products, Inc., establishes a new milestone in the history of lighting. Shown publicly for the first time in a dramatically darkened setting at New York City's Waldorf-Astoria Hotel, this new light source was described as "a plane of light," or "an area light source." For all practical purposes, it is two-dimensional, since its thickness is on the order of 1/100th of an inch thick. It has been given the trade name of "Panelite."

Commercial availability of "Panelite" at present, Sylvania reported, is limited to two types, both green. One type has a luminosity of 1/10th footlambert, when the lamp is connected to the standard 120-volt, 60-cycle circuit. The other type has a luminosity of 2.0 footlamberts when the voltage is increased to 500 volts.

RURAL transformer & equipment co.

SINGLE STEP, LINE TYPE VOLTAGE REGULATOR LEADS ARE INSULATED AND PROTECTED WITH NATVAR 400 EXTRUDED VINYL-BASE TUBING



Newest addition to the Ruralformer line is this low cost pole mounted Type 1R Voltage Regulator. It helps save line copper and reduces customer complaints by automatically furnishing a 3.75% boost when required. This inside tank view shows core and coil assembly and the resistor side of the main switching assembly. All leads are insulated and protected with Natvar 400 extruded vinyl-base tubing.

The Rural Transformer & Equipment Co., Milwaukee, manufactures distribution transformers and associated equipment. They have developed a low cost, high surge strength transformer for distribution of rural power at 14,000 volts. With externally operated tap changer, bonded coils, and externally mounted protection against lightning surges and overload, Ruralformers carry a strong service guarantee.

Component parts and materials have been carefully picked. Natvar 400 extruded vinyl-base tubing is used to insulate and protect leads because of its consistently superior resistance to both oil and heat.

It will pay you to use Natvar 400 tubing, tape, and other Natvar flexible insulating materials for your requirements. They are available either from your wholesaler's stock or direct from our own.

Natvar

Natvar Products

- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished silk
- Varnished special rayon
- Varnished Fiberglas cloth
- Silicone coated Fiberglas
- Varnished papers
- Slot insulation
- Varnished tubings and sleevings
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded vinyl tubing and tape
- Extruded vinyl identification markers

Ask for Catalog No. 21

THE NATIONAL VARNISHED PRODUCTS Corporation

Telephone Rahway 7-8800 — Cable Address NATVAR: Rahway, N. J.

205 RANDOLPH AVENUE ★ WOODBRIDGE, NEW JERSEY

SOMETHING NEW IN OUTLET BOXES

Catalog No. 9-OX, 4" octagon, bevel corner outlet box, 1½" deep, for non-metallic sheathed cable. Readily accommodates cable coming in from back or side.

The M. B. Austin Company
NORTHBROOK, ILLINOIS

Write for Information and Prices

Favorite of the 2-piece 90 degree connectors is Kwikon's No. 6633 —the smooth, malleable iron base and stamped steel, perfect-fitting cover. The ½-inch locknut is the preferred spline type of stamped steel.

You will find it at most wholesalers now, available in quantity for use with industrial products, for maintenance or construction work.

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Among the Manufacturers

Headquarters Announcements

Westinghouse Electric Corp., Pittsburgh, Pa.—Dr. W. H. Brandt, manager of the Special Products Development Division; Thomas R. Lawson, assistant sales manager of industrial products; Formation announced of the Canadian Westinghouse Supply Co.

General Electric Company, Schenectady, N. Y.—Robert Paxton, executive vice president; William A. Sredenschek, manager of materials and purchasing for the company; William V. O'Brien, manager of the Apparatus Marketing Division.

General Electric Company, Bridgeport, Conn.—Dorcey F. Hines, manager of utility sales for the Major Appliance Department.

Essex Wire Corp., Fort Wayne, Ind.—announces the formation of an organization for the design, development, manufacture and marketing of luminous tube (neon), oil burner ignition and fluorescent lighting transformers.

Allis-Chalmers Company, Boston, Mass.—George W. O'Keeffe, manager of sales.

Day-Brite Lighting, Inc., St. Louis, Mo.—Gilbert C. Nieburg, assistant general sales manager.

Mica Insulator Company, Schenectady, N. Y.—Malcolm S. MacGruer, sales manager.

Inland Steel Container Co., Milwaukee, Wis.—J. Doyle Moore, Specialty Products Sales Manager for Comforteer Heaters.

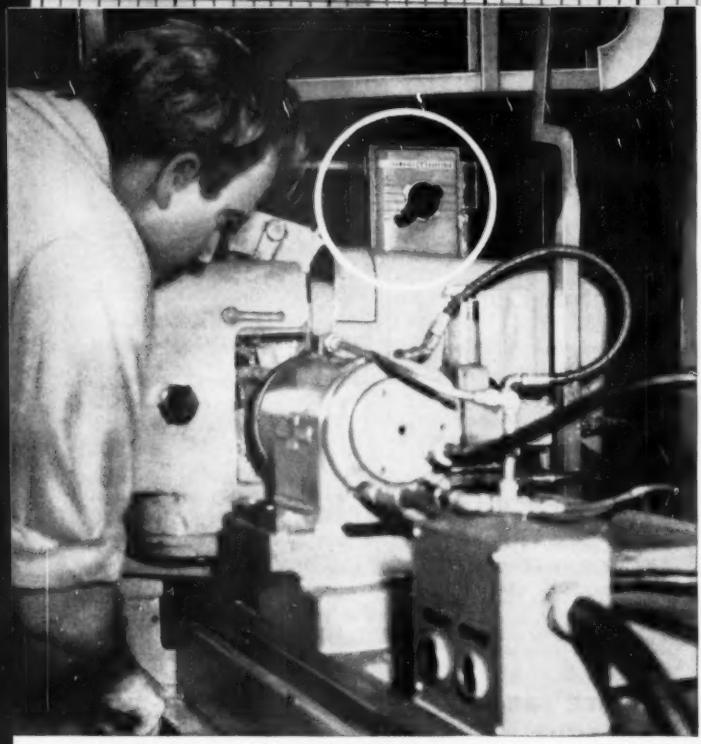
General Electric Company, Fort Wayne, Ind.—B. R. McClure, assistant to the manager of sales of the Fractional Horsepower Motor Divisions.

Universal Motor Company, Oshkosh, Wis.—E. G. Henderson, general sales manager.

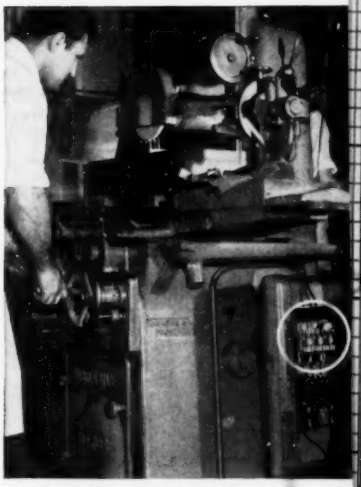
National Electric Products Corp., Pittsburgh, Pa.—Vincent P. Oatis, Jr., sales engineer for underfloor wiring systems.

General Electric Company, Schenectady, N. Y.—R. S. Walsh, manager of the Induction Motor Sales Division.

Thomas & Betts Company, Elizabeth, N. J.—N. J. MacDonald, vice presi-



IN SAFETY SWITCHES—Marlin-Rockwell Corporation's ball bearing factories use 30 ampere HCI switches as disconnects for high frequency motors used to power internal grinders. HCI interior is removable for easy wiring and inspection. No exposed live parts when switch is OFF and door open. Underwriters' Laboratories Approved.



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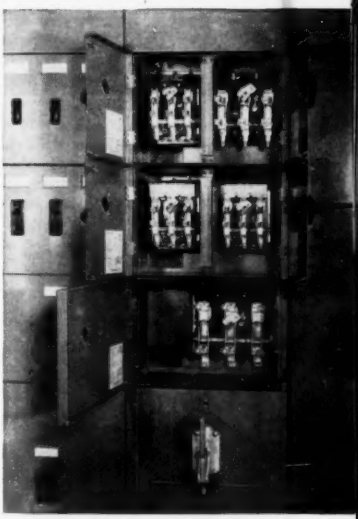

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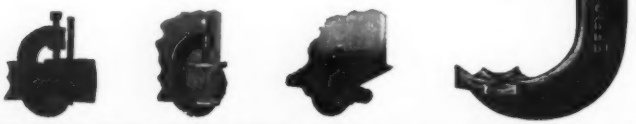

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Appleton Electric Co., Chicago, Ill.—announces plans for a branch plant at Birmingham, Ala.

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MIDDLE ATLANTIC

Mathias Klein and Sons: Bamford E. Rogers, Paterson, N. J., sales representative for the northeastern part of the United States.

Sterling Electric Motors, Inc.: Joseph P. Foley, Chas. E. O'Leary and Raymond S. Portner, staff of the New York City district office.

Clyde W. Lint: Coughlin Electric Sales, New York, N. Y., representative in the Metropolitan area; Lester E. DeWald, Syracuse, N. Y., representative in upstate New York.

Trumbull Electric: Douglas J. Donohue, Philadelphia, Pa., Atlantic District sales manager.

Buchanan Electrical Products Corp.: John R. Schmidt, Pittsburgh, Pa., western Pennsylvania-West Virginia representative.

General Electric Company: G. H. Campbell, manager of the Newark, N. J., office.

Westinghouse Electric Supply Co.: William H. Bingham, Long Island City, N. Y. eastern district manager.

Star-Kimble Motor Division: Howard Elliott, sales representative for Long Island, Staten Island and Brooklyn; Frank J. Scanlan, sales representative for northern New Jersey.

General Controls Company: F. J. Wengerter, New York District manager.

SOUTH ATLANTIC

Westinghouse Electric Corp.: Robert E. Ferry, manager of apparatus sales offices in Wheeling and Fairmont, West Virginia.

Sterling Electric Motors, Inc.: H. L. Fritz, Baltimore, Md., representative for the Maryland territory.

Paranite Wire and Cable Division: New warehouse and office facilities in Atlanta, Georgia.

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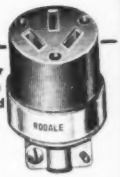

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The Electric Products Co.: N. G. Denbroeder, Toledo, Ohio, sales representative.

Reliance Electric and Engineering Co.: Lloyd F. Giegel, branch manager of the Gary, Ind., sales office.

The Standard Transformer Co.: Carl A. Froebel Company, representative for eastern Missouri and southern Illinois.

General Electric Company: Jack M. Lime, Cleveland, Ohio, manager of the Buckeye Sales District of the Lamp Division.

General Controls Company: Charles Tabor, Cleveland District manager; Bud Lerch, Chicago District manager.

WEST CENTRAL

Sterling Electric Motors, Inc.: Robert P. Killion, Houston, Texas, District manager for southeastern Texas.

Edwards Company, Inc.: R. L. Browne Co., Kansas City, Mo., representative in Kansas and Western Missouri.

General Electric Company: Harold R. Berkal, Omaha, Nebraska, wire and cable specialist for the Construction Materials Department's central district.

General Controls Company: A. E. "Bud" Hess, Houston (Texas) District manager.

Chelsea Fan and Blower Co.: H. R. Onarecker, Houston, Texas, representative for the state of Texas.

General Electric Company: Dean M. Warren, Kansas City, Mo., manager of the Midwest Sales District of the Lamp Department.

WEST

Sterling Electric Motors, Inc.: Melvin Maxham and John Malloy, sales staff of the Los Angeles headquarters; John F. Ingle, San Francisco, Calif., district manager for central and northern California, and western Nevada.

General Controls Company: Herbert Lindstrom, Denver District manager.

General Electric Company: L. Maynard Stauffer, Denver, Colo., manager of the Rocky Mountain Apparatus district; C. R. Benson, San Francisco, Calif., cable specialist for Pacific District, Construction Materials Department.

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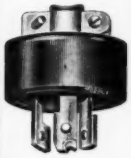

NEW 3-Wire Rubber Attachment Cap with Cord Clamp

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Turn-Tyte

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20 amp— Catalog #1229 O. D. 1¾"

Brass Blades and Screws
Cord hole .625

3-Wire Polarized Rubber Attachment Cap with Cord Clamp

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ELECTRICAL DESIGN SPEEDS PRODUCTION

[FROM PAGE 37]

With this multiplicity of switchgear, it is possible to control the plant as a whole or departments, sections and machines individually.

In the heat-treating section, where temperatures above ovens are high and where overhead traveling cranes operate, all branch circuits are carried in floor trenches, sweeping up into control panels at each oven ram-feed station, thus reducing ambient temperatures of cables and leaving crane paths free.

Cascading control is also applied to lighting circuits so that, if a single machine or small area is being used during a generally-idle shift, it is possible to illuminate only the area occupied rather than light an entire section, as would be the case with central division-controlling panelboards.

Fire alarm stations strategically located throughout the office, research, storage and production areas combine call buttons, warning horns and annunciator boards. Safety-trained company personnel go to the nearest fire station, note the location of the emergency and, upon arrival at the danger point, have the use of numerous hose lines, carts, fire-fighting aids, foam and CO_2 extinguishers.

Manufactured in this plant are speedclips for fastening cables, clamps for conduit support and nuts for many applications. Developed along the simple principle of an arched spring-steel strip having curved prongs to engage screw threads or to grasp shanks, these products are self-locking, cannot freeze to bolts or screws due to corrosion, eliminate the labor and cost involved in the use of lock washers and can be re-used indefinitely.

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This is a product of consulting engineers McGeorge, Hargett and Associates. Electrical construction was by the Parker Electric Company of Cleveland.

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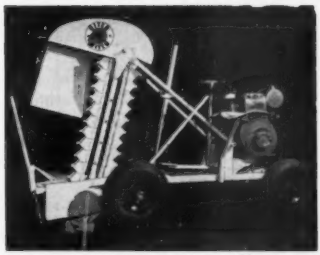

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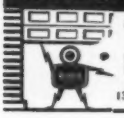

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POWER FOR X-RAY

[FROM PAGE 42]

yet official. For completeness, they are included as Figure 2.

Multiple Installations

No standards exist for wiring for an x-ray department having several high powered x-ray generators. The explanation of the Table of Minimum Power Supply Requirements recognizes that the problem exists.

A precise prediction of the maximum load in an x-ray department or a precise prediction of the probability of a given load occurring is impossible because of the uncertainty of the use to which any given x-ray machine will be put.

Unlike the study of certain other intermittent power loads, a study of the x-ray load should take into account not only "off" time and time of operation at full load, but also time of operation at several possible loads at a fraction of full power. A simple diversity factor cannot be used with acceptable accuracy.

The probability of certain loads occurring for a 1000 bed charity hospital with five high-powered radiographic generators has been worked out. Its accuracy is only as good as the accuracy of the assumptions of the use. The assumptions of use have been made very high to be conservative. They are based on one hour use of each room at the highest probable sustained level, and the further assumption that all rooms are being so used during the same hour.

A load of 463 amperes could occur if all machines were operated at full rating simultaneously. However, the intermittent character of the load at each machine and the varying length of operating cycles make simultaneous full load improbable.

The probability of exceeding 300 amperes is 1.57×10^{-6}. In other words, with one 500 ma unit and four 200 ma units assuming the highest load combination which is realistic, even though 463 amperes could be reached, the odds for reaching 300 amperes in any hour of peak operation are about one in a billion. Assuming 5 hours a day at this high operating rate and 300 days a year, one should expect to exceed 300 amperes about once every one million years. We can probably afford the risk.

It is hoped that this will be some guide where none existed before to assist the engineers in the problem of what load to prepare for with multiple installations.

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- water heaters
- coffee makers
- clocks
- dishwashers
- air conditioners
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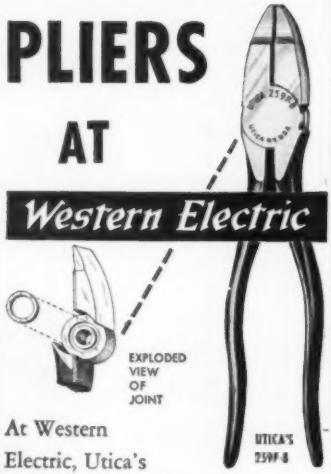

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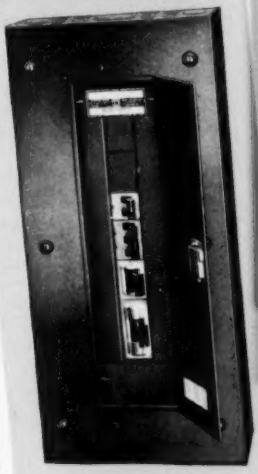

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